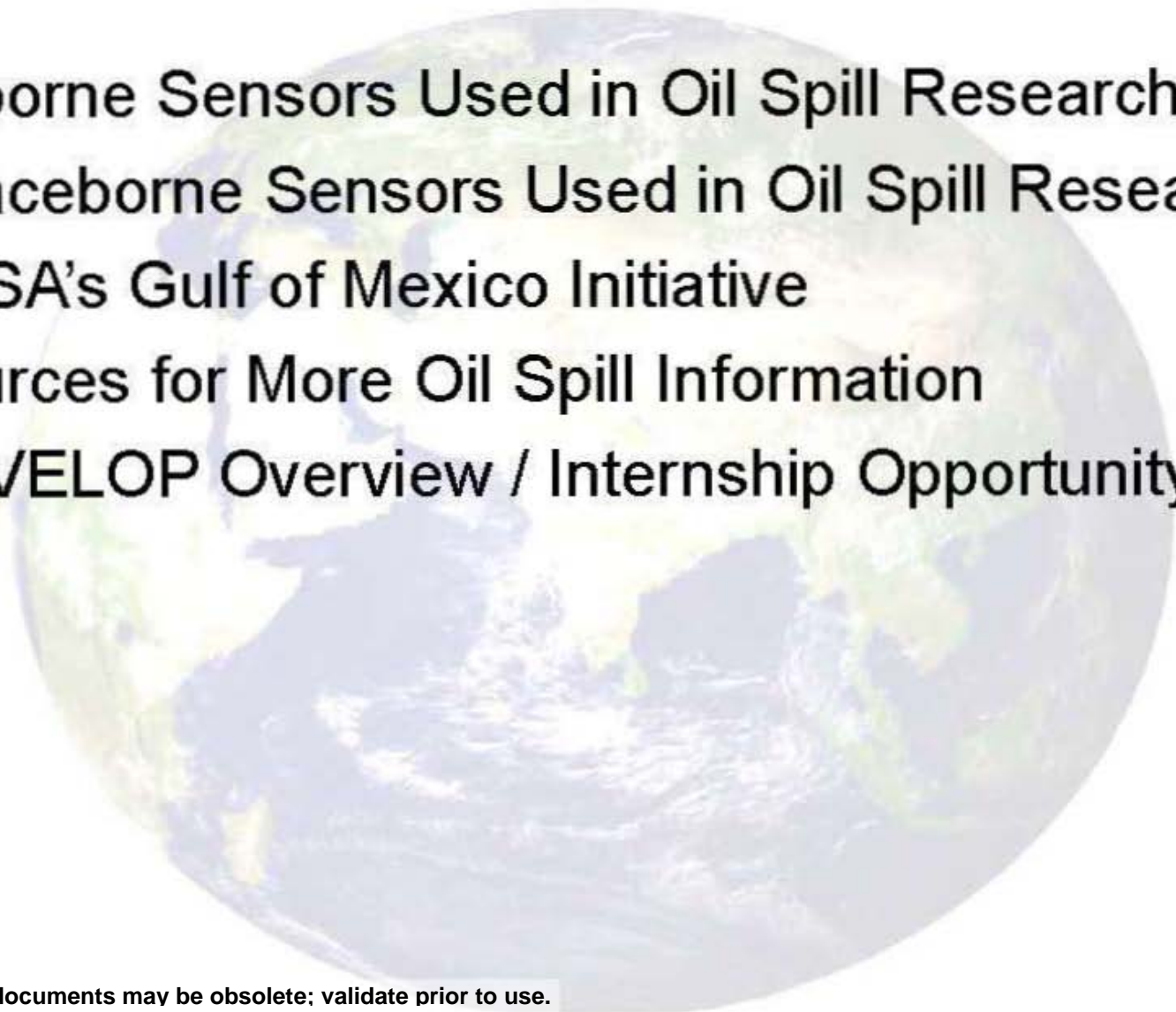


Presentation Outline



- Airborne Sensors Used in Oil Spill Research
- Spaceborne Sensors Used in Oil Spill Research
- NASA's Gulf of Mexico Initiative
- Sources for More Oil Spill Information
- DEVELOP Overview / Internship Opportunity



A large, semi-transparent satellite image of Earth serves as the background for the title. It shows a view of the Earth from space, with the continents of North and South America visible. The image is slightly faded to allow the text to be read clearly.

NASA Airborne Sensors

HSRL



- High Spectral Resolution LiDAR
- Aerosol sensor (green and NIR wavelengths)
- Flew aboard NASA's King Air (May 9-10; July 9-10)
- Experiments with sub-surface oil analysis



Technician Checks Out King Air During Oil Spill
RELEASED - Printed documents may be obsolete; validate prior to use.
Deployment. Image Credit: NASA

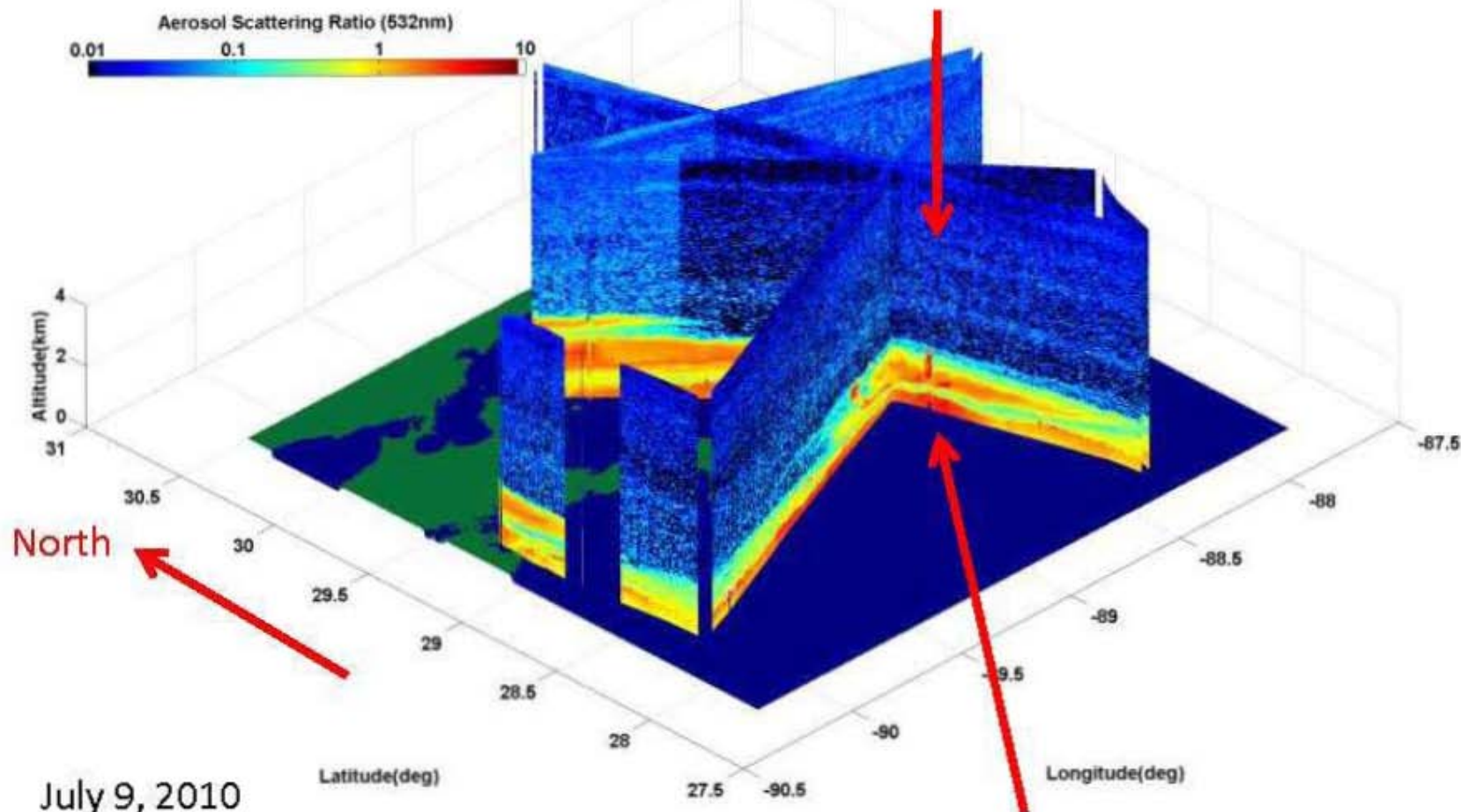


HSRL Deployed in NASA Langley's King Air B200
Image Credit: NASA

HSRL



Oil Rig located SE of intersections of tracks:



July 9, 2010

Note dark red peak of smoke plume from controlled oil burn.

AVIRIS



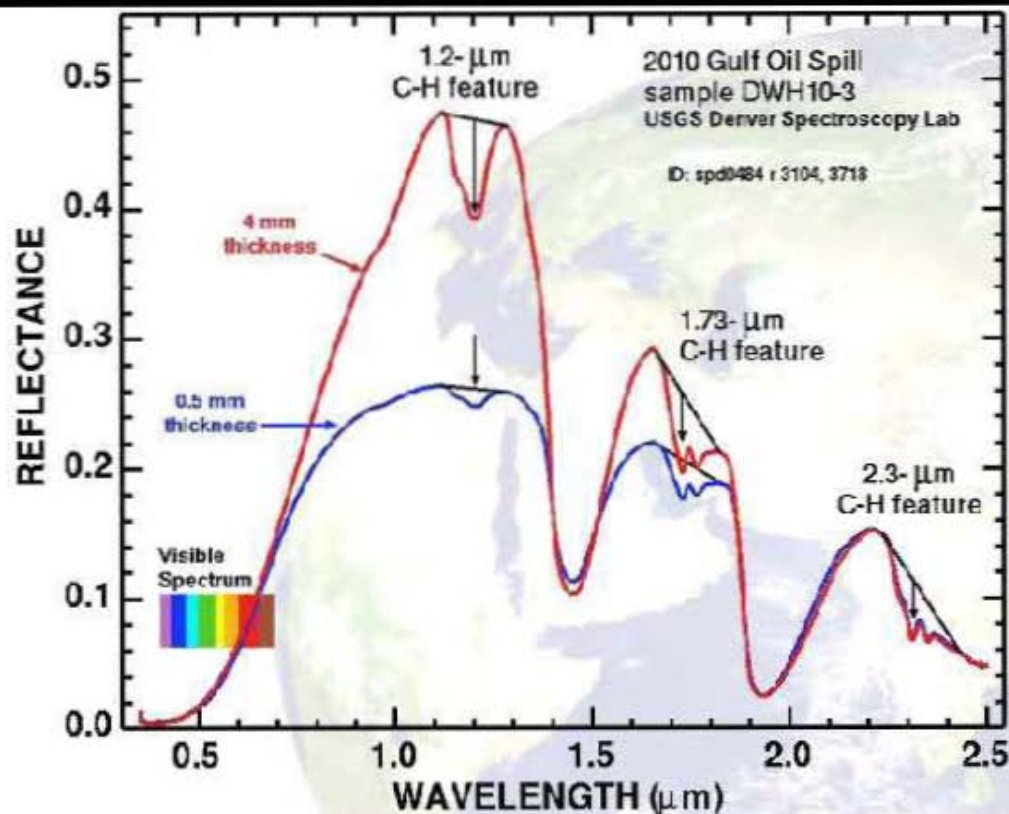
- Airborne Visible / Infrared Imaging Spectrometer
- Hyperspectral sensor – numerous wavelengths
- Spatial resolution: 3 m – 20 m (based on altitude)
- Flights in May, July, and August
- Oil thickness mapping – USGS, NASA, UCSB
- Wetland monitoring – UCDavis, UCSB, USGS



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ER-2 Aircraft Carrying the AVIRIS Sensor. Image Credit: NASA

AVIRIS



Spectral Signature of Gulf Oil Sample (Above)

Source: USGS

<http://pubs.usgs.gov/of/2010/1101/>

Oil to Water Ratio Map (Right)

Source: USGS

<http://pubs.usgs.gov/of/2010/1167/>

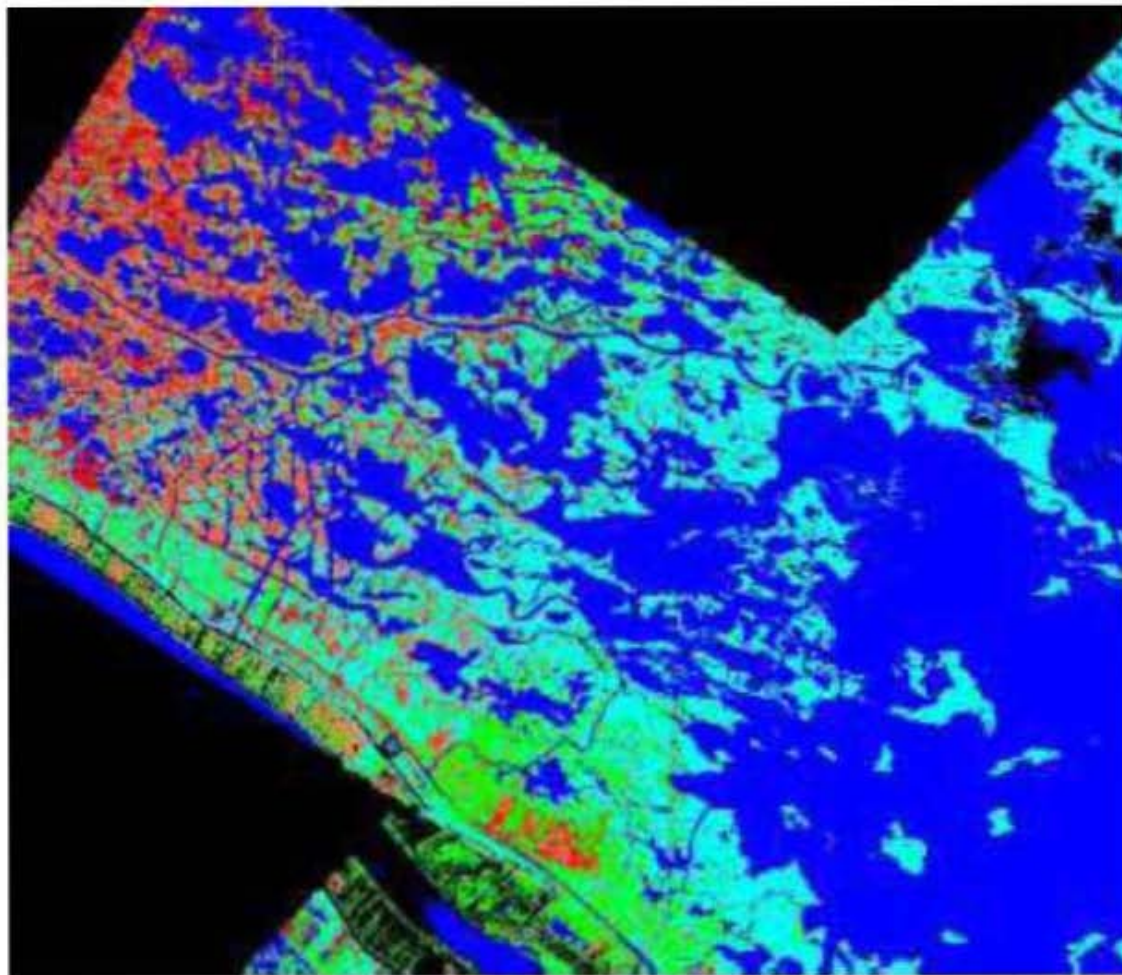
AVIRIS Visible Color Composite

AVIRIS Oil:Water Ratio Map
May 17, 2010, Run 11

USGS, NASA, UCSB

Oil:Water
>90:<10
80:20
60:40
40:60
23:77
6:94
1:99
~60:40
Low
Areal
Fraction

AVIRIS



- Water / Glint
- Phragmites australis*
- Spartina alterniflora*
- Spartina patens*
- Vigna luteola*
- Background

Wetlands Vegetation Species Maps Generated from 16-meter Resolution AVIRIS Imagery
Acquired over Southeast Louisiana on May 6, 2010.

RELEASED - Printed documents may be obsolete; validate prior to use. Image Credit: Dr. Dar A. Roberts et al., UCSB

UAVSAR



- Uninhabited Aerial Vehicle Synthetic Aperture Radar
- Flown aboard NASA's Gulfstream G-III aircraft
- L-band radar: experimental analysis of marsh oiling



NASA's Gulfstream G-III Aircraft with UAVSAR Mounted Undemeath

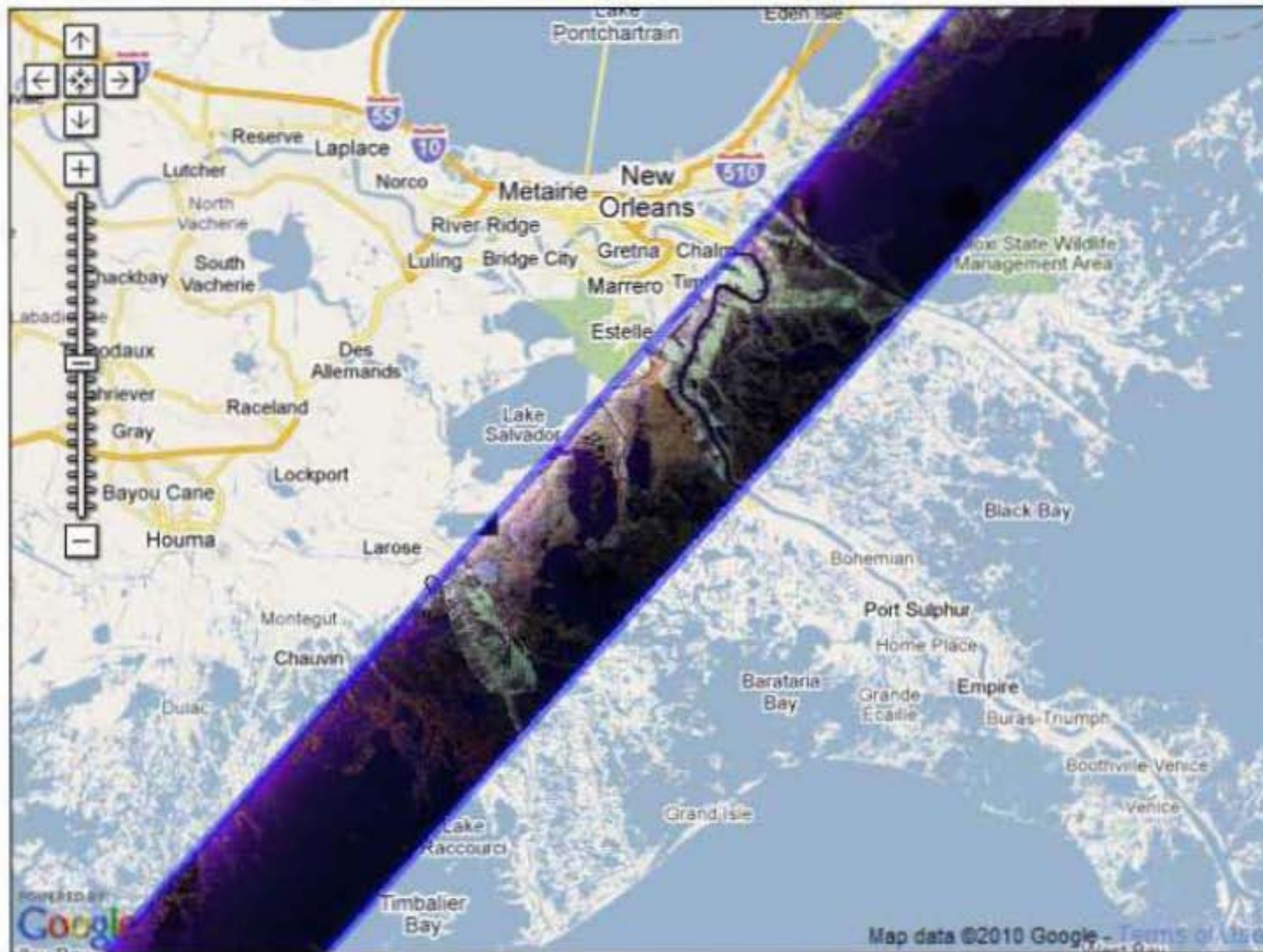
RELEASED - Printed documents may be obsolete; validate prior to use.

Image Credit: NASA

UAVSAR



Polarimetric Image of Louisiana Marsh - Mississippi Delta, LA (June 22, 2010)



Example Strip of UAVSAR Data Acquired over Southeast Louisiana, June 22, 2010

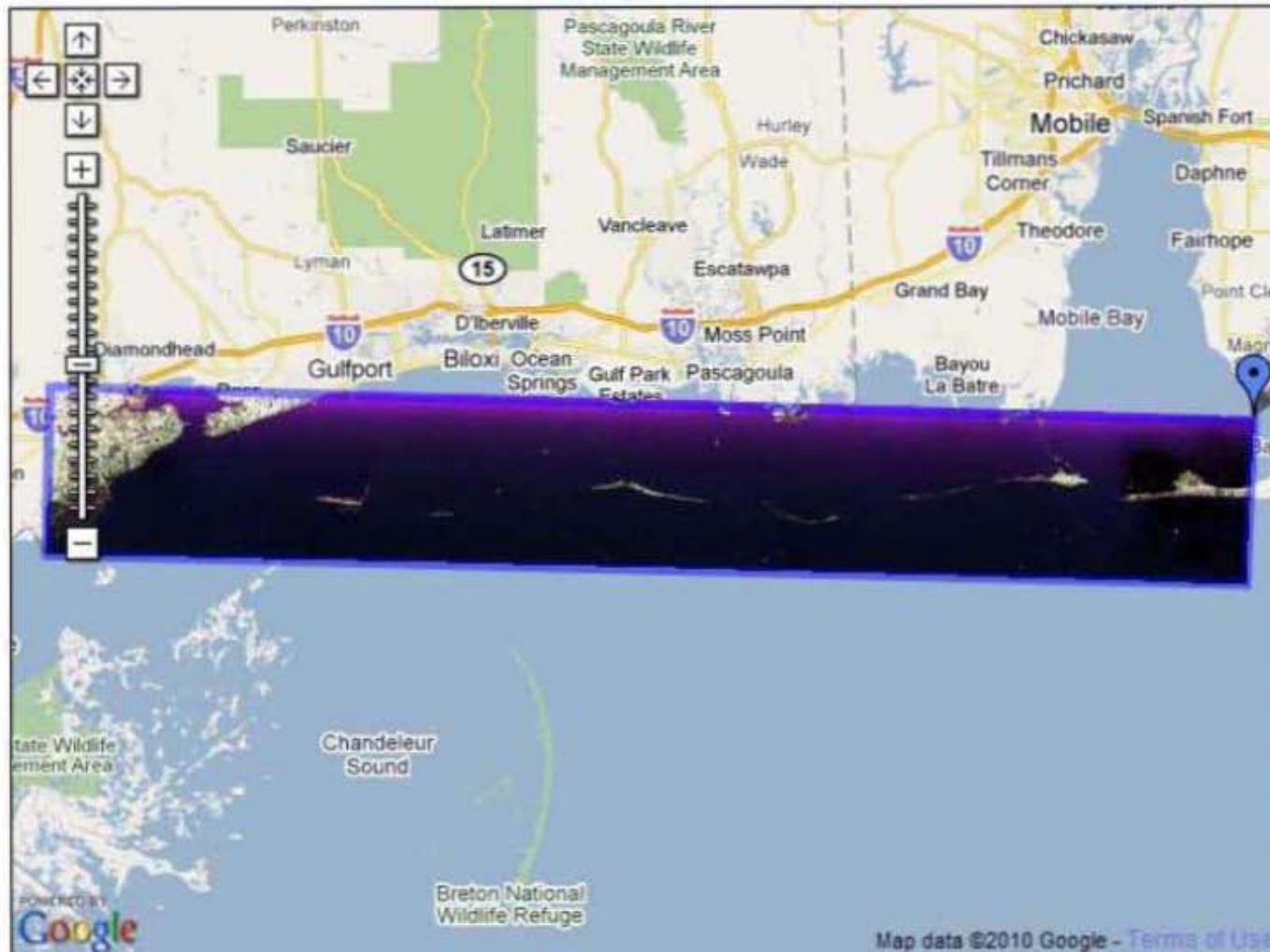
RELEASED - Printed documents may be obsolete; validate prior to use.

Image Credit: NASA

UAVSAR



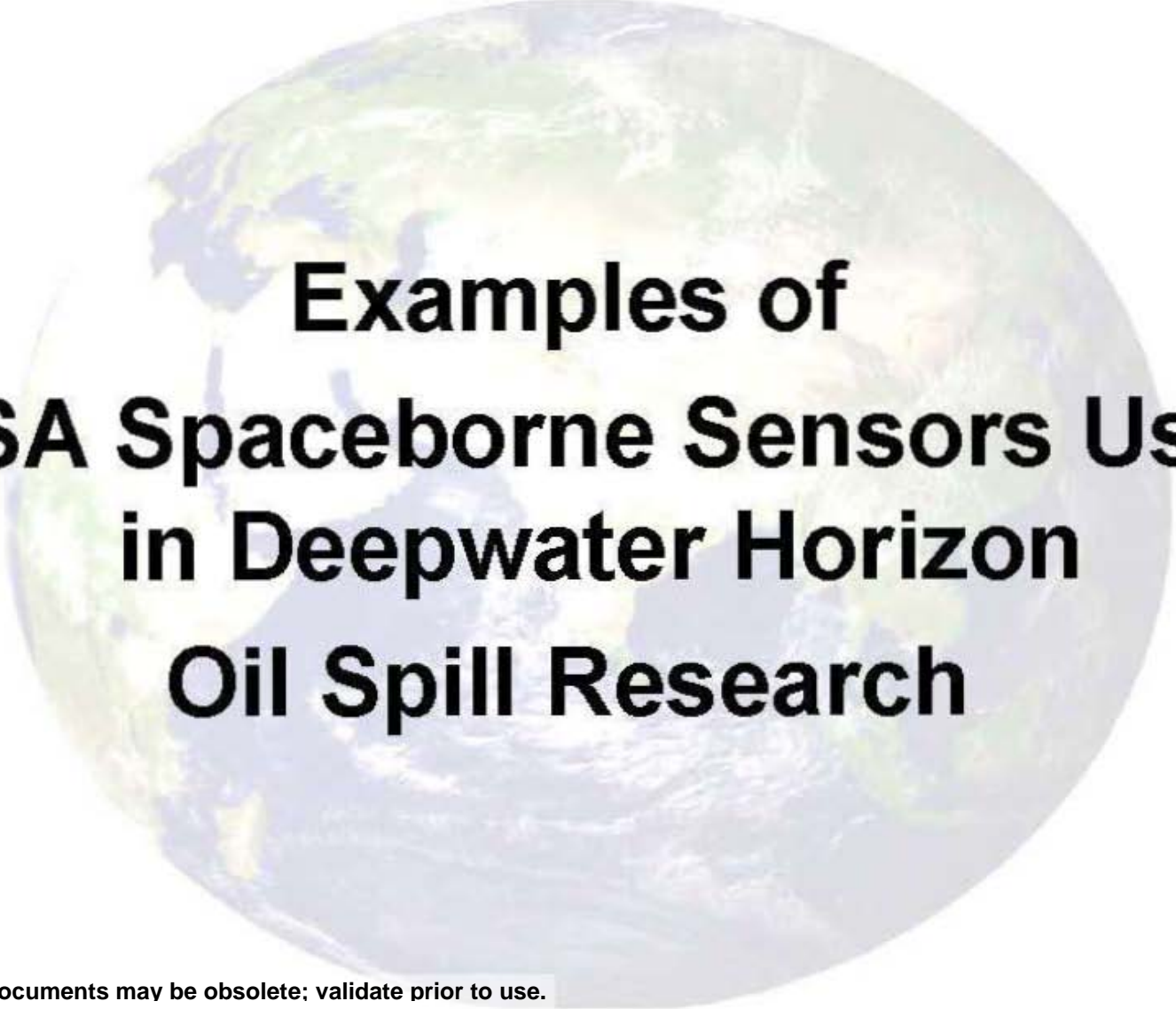
Polarimetric Image of Barrier Islands, MS (June 22, 2010)



Example Strip of UAVSAR Data over MS and AL Barrier Islands – June 22, 2010.

RELEASED - Printed documents may be obsolete; validate prior to use.

Image Credit: NASA

A large, semi-transparent satellite image of Earth serves as the background for the title text. The image shows a view of the Earth from space, with visible cloud patterns and landmasses. The text is overlaid on this image.

Examples of NASA Spaceborne Sensors Used in Deepwater Horizon Oil Spill Research

NASA's Oil Spill Imagery: MODIS



- Moderate Resolution Imaging Spectroradiometer
- Flies over twice daily (*Aqua* and *Terra* satellites)
- Surface oil visible in sun glint



Terra MODIS Image of Deepwater Horizon Oil Spill – April 29, 2010

MODIS – April 21, 2010



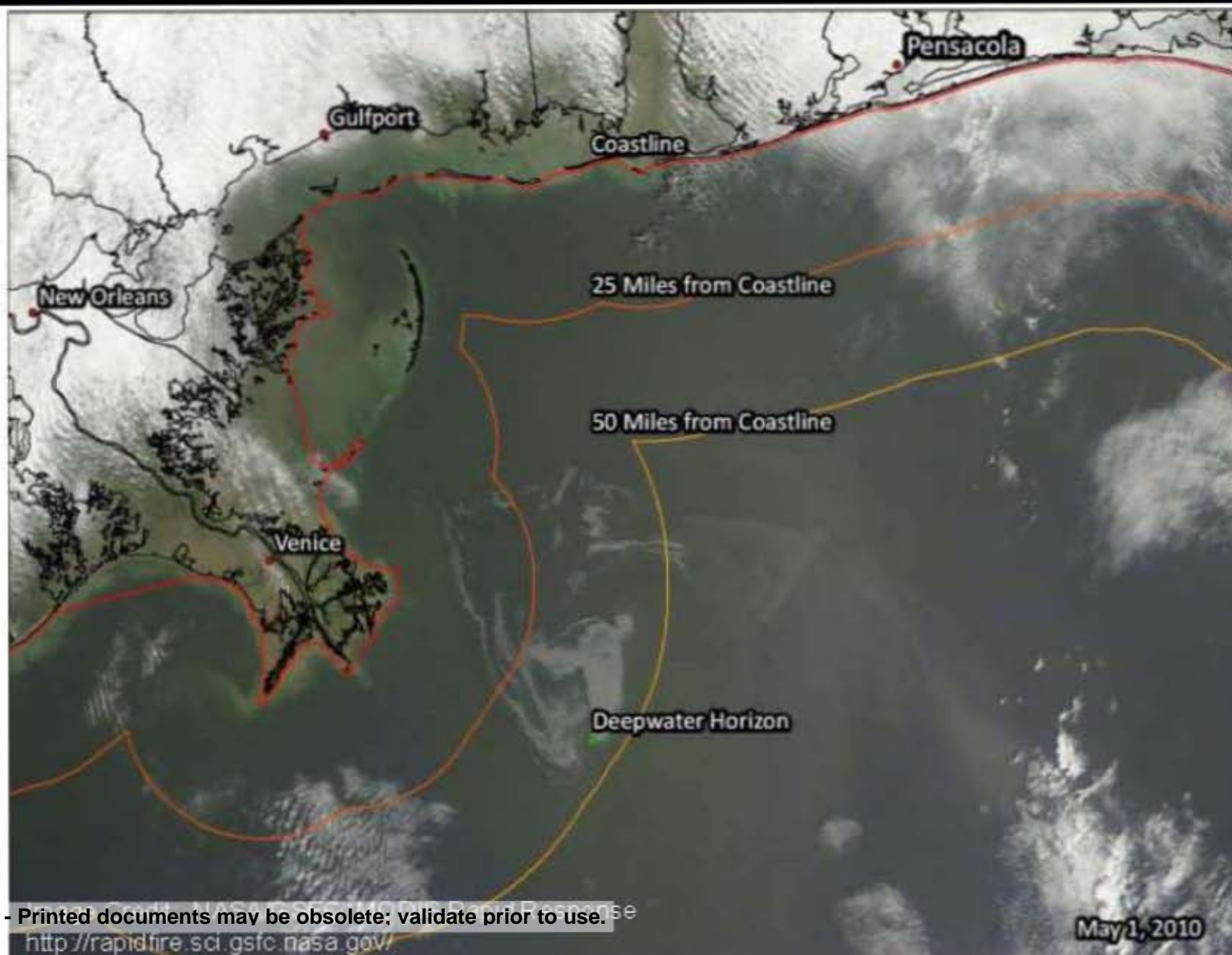
MODIS – April 25, 2010



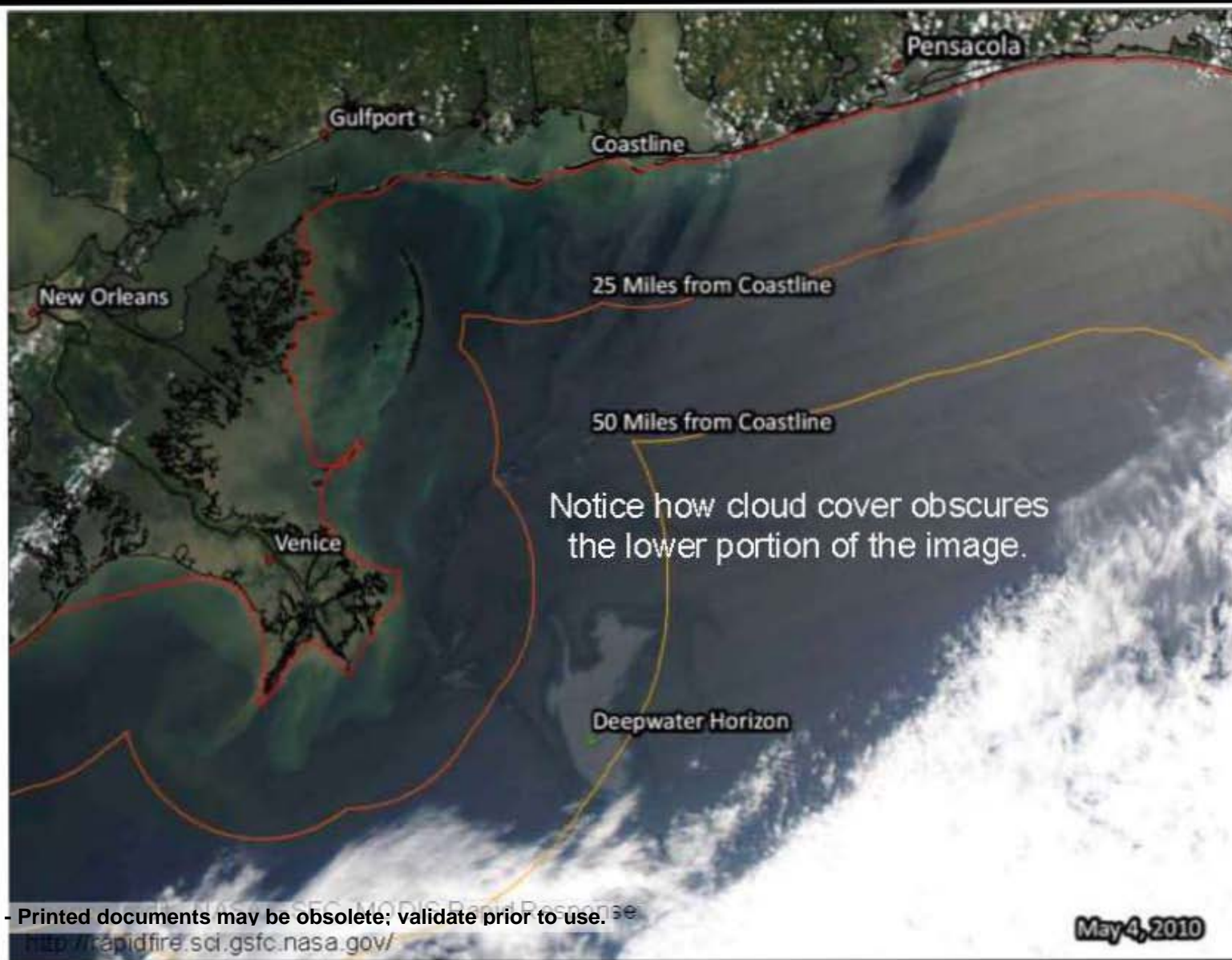
MODIS – April 29, 2010



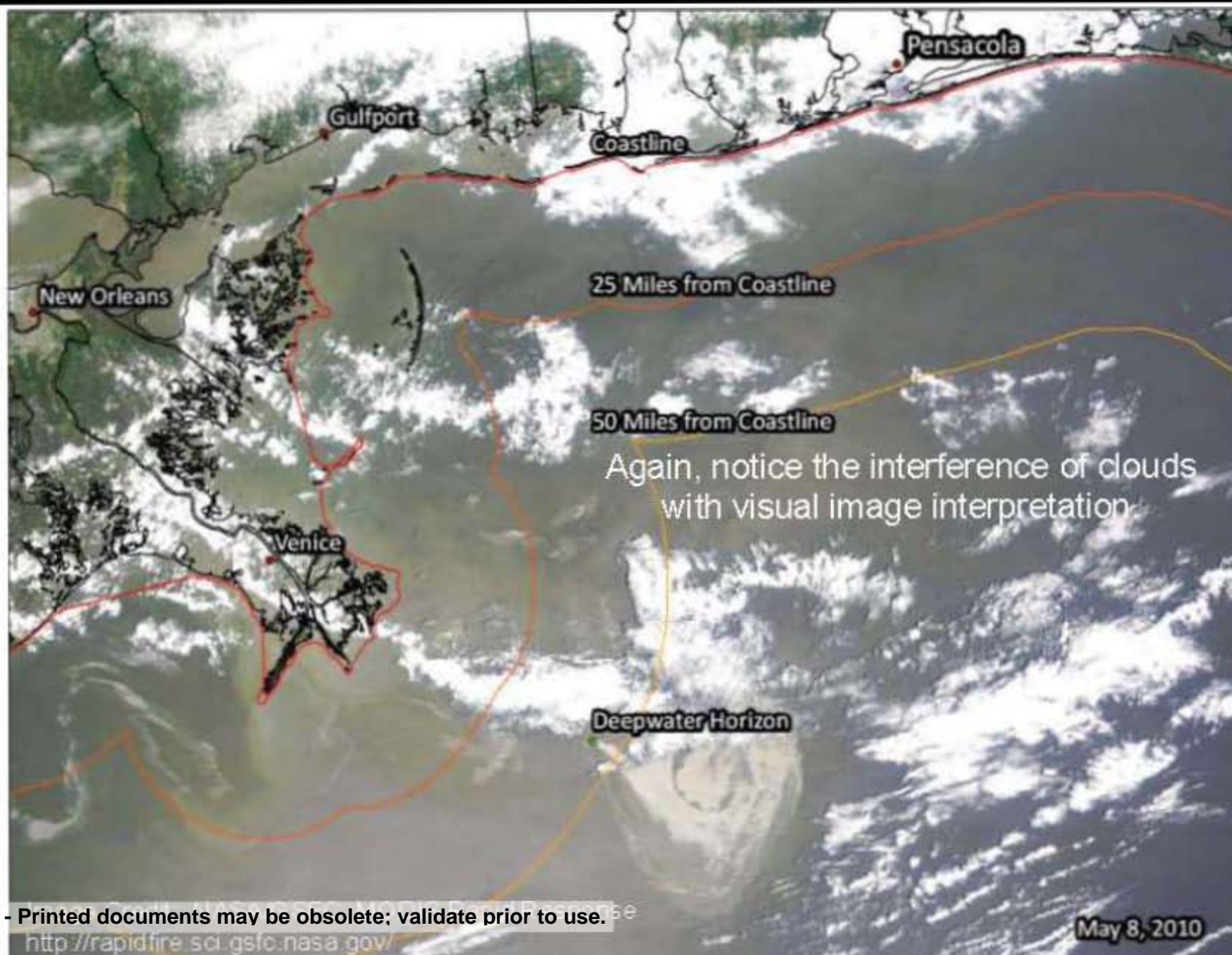
MODIS – May 1, 2010



MODIS – May 4, 2010



MODIS – May 8, 2010



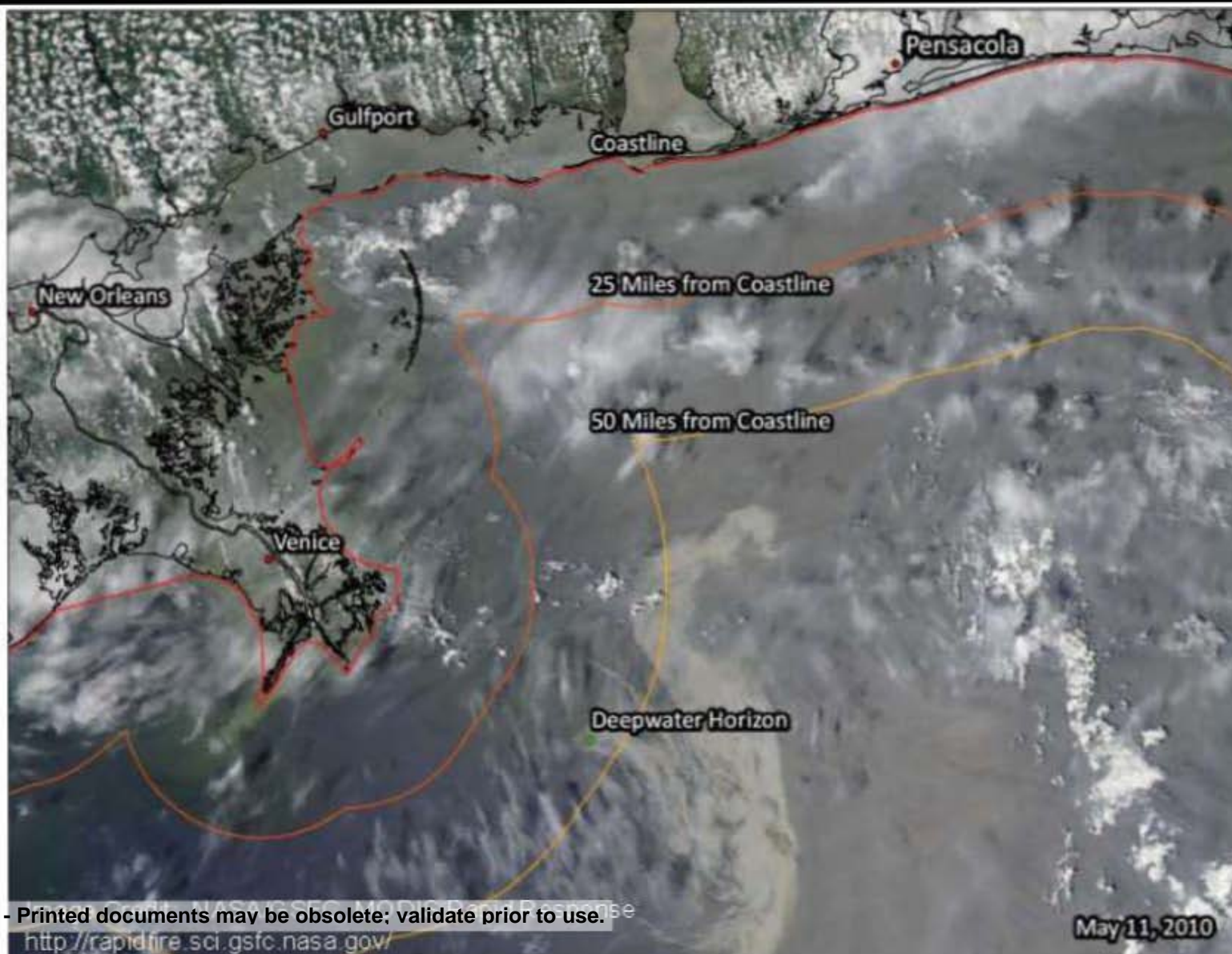
MODIS – May 9, 2010



MODIS – May 10, 2010



MODIS – May 11, 2010



MODIS – May 17, 2010



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<http://rapidfire.sci.gsfc.nasa.gov/>

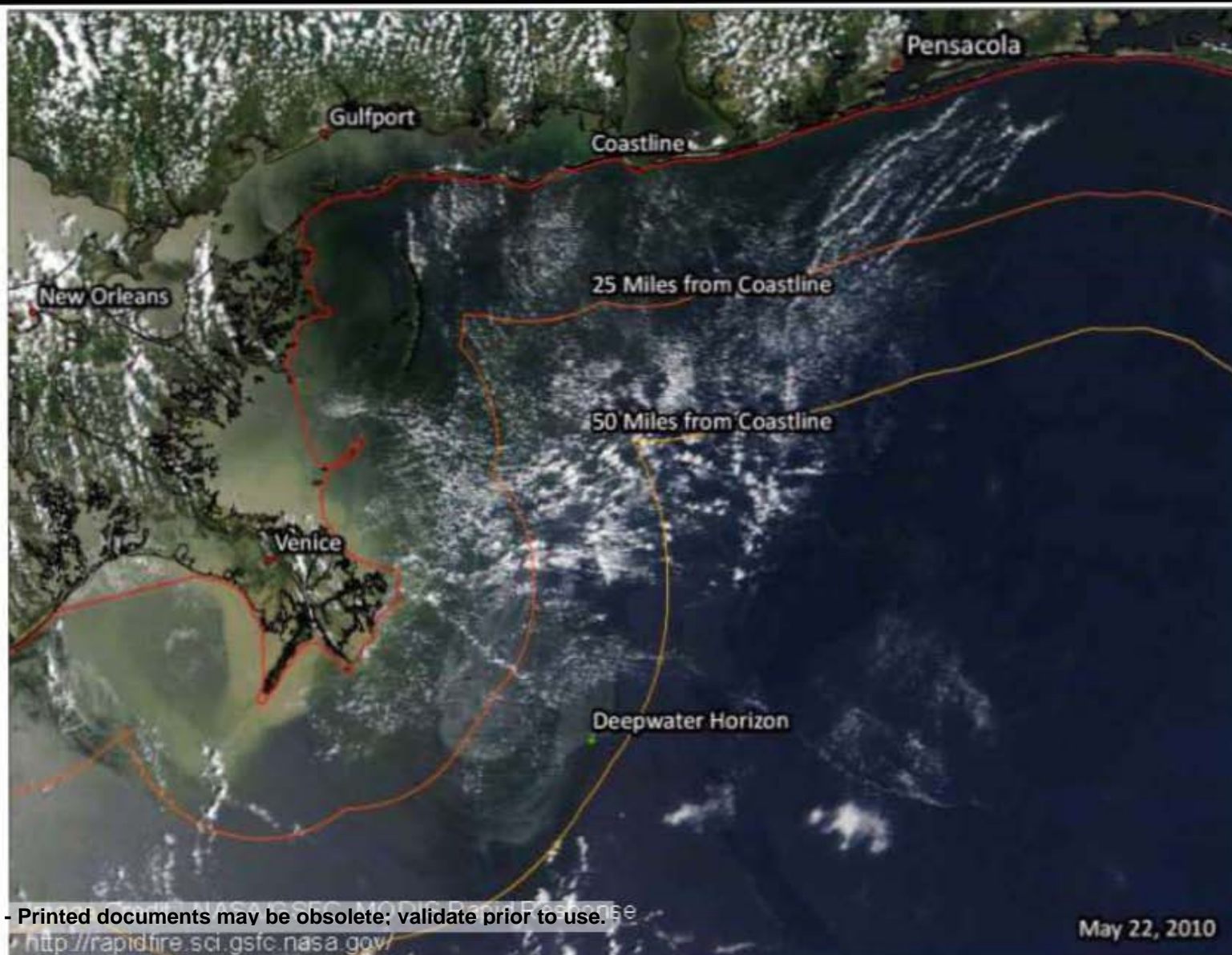
MODIS – May 18, 2010



MODIS – May 20, 2010



MODIS – May 22, 2010



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<http://rapidfire.sci.gsfc.nasa.gov/>

May 22, 2010

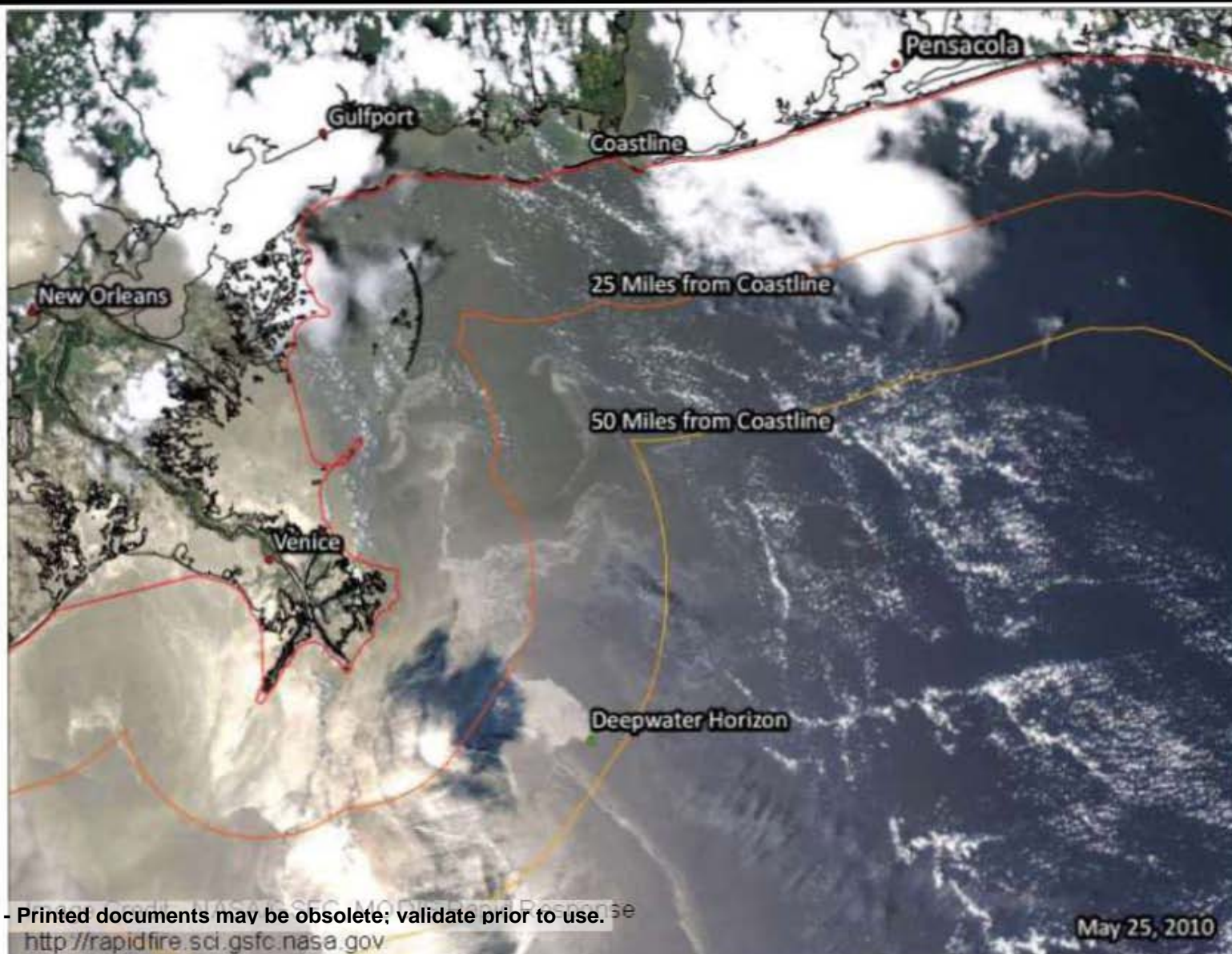
MODIS – May 24, 2010



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<http://rapidfire.sci.gsfc.nasa.gov/>

MODIS – May 25, 2010



MODIS – May 27, 2010



RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov/>

May 27, 2010

MODIS – June 10, 2010

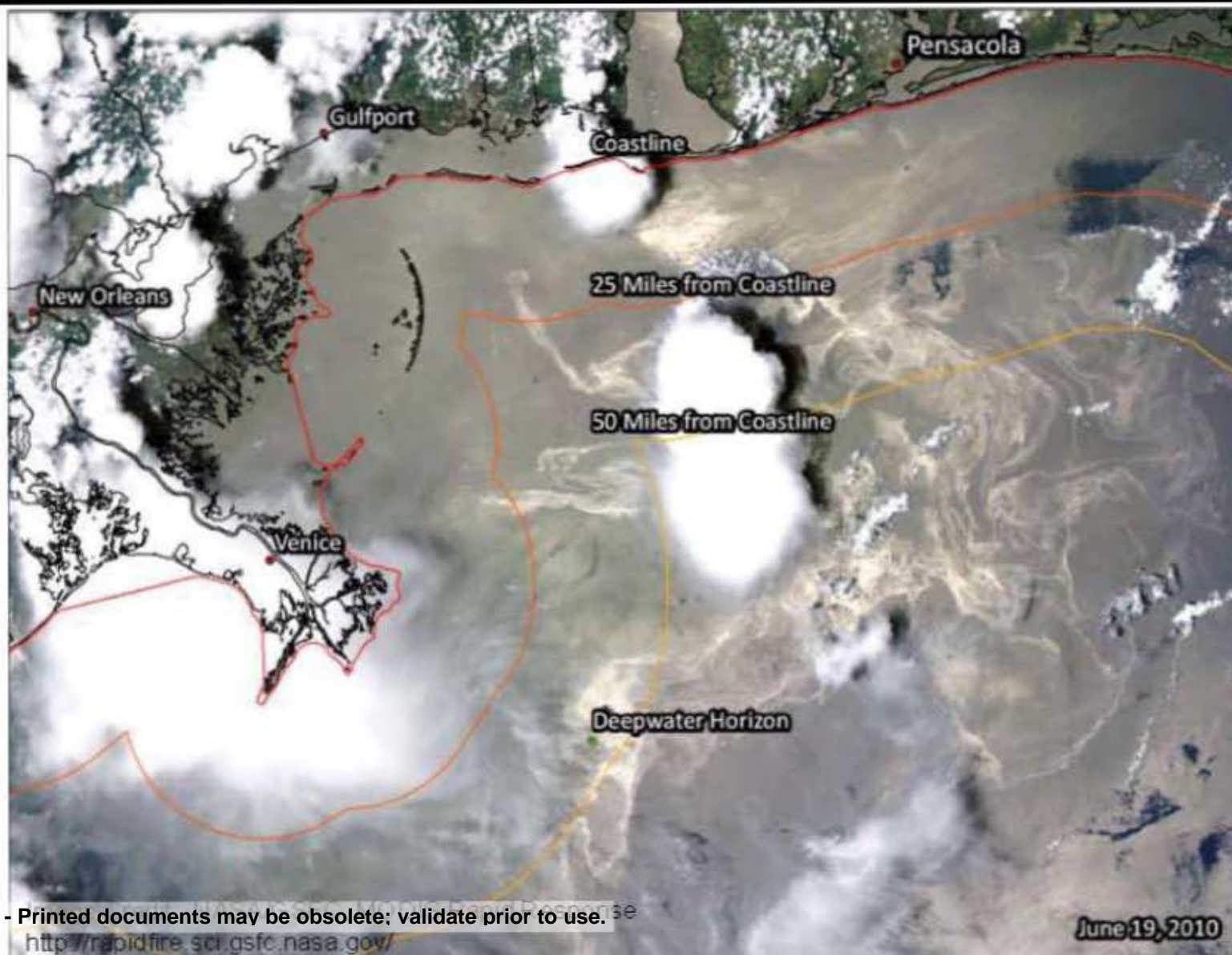


RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov/>

June 10, 2010

MODIS – June 19, 2010

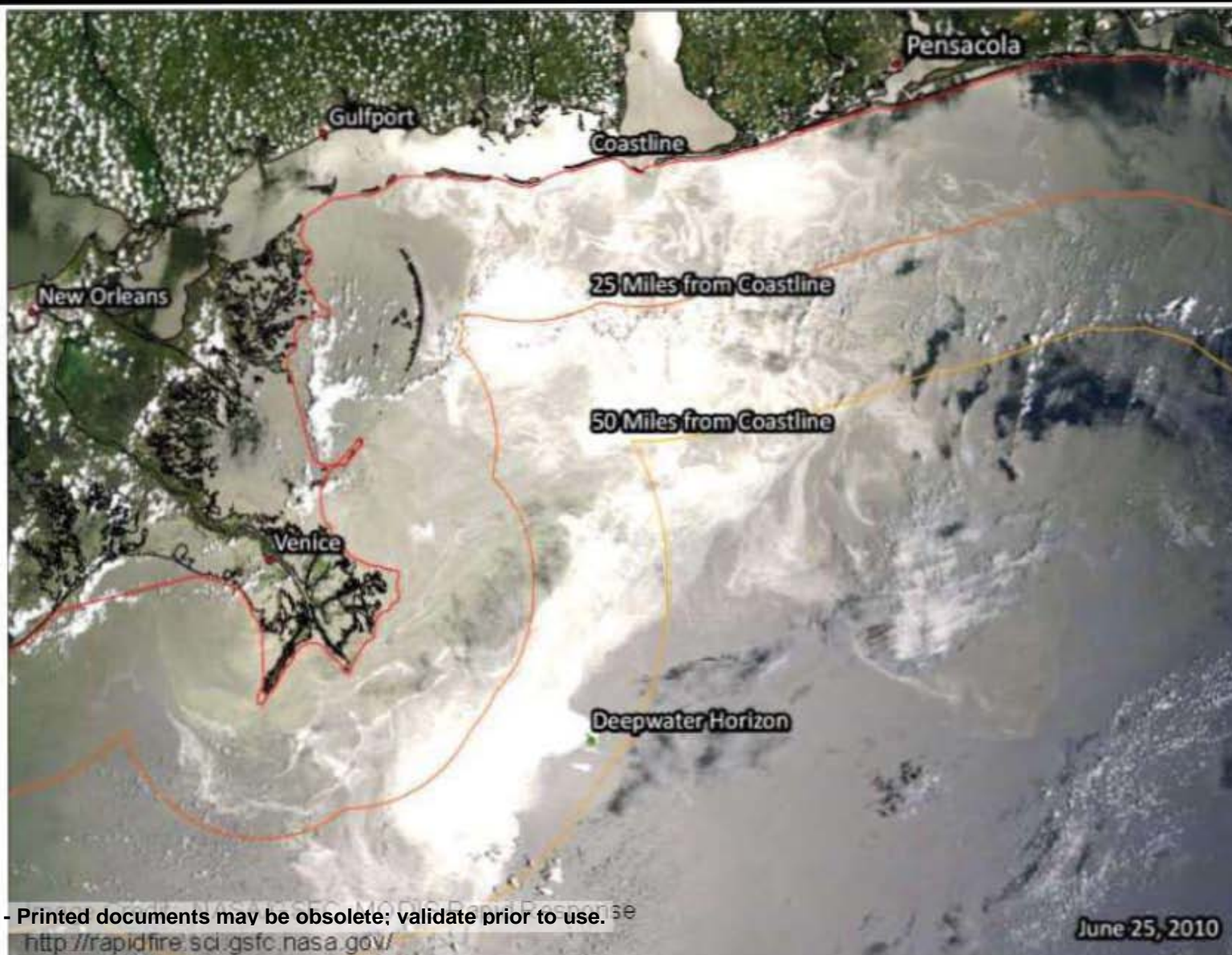


RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov/>

June 19, 2010

MODIS – June 25, 2010



RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov/>

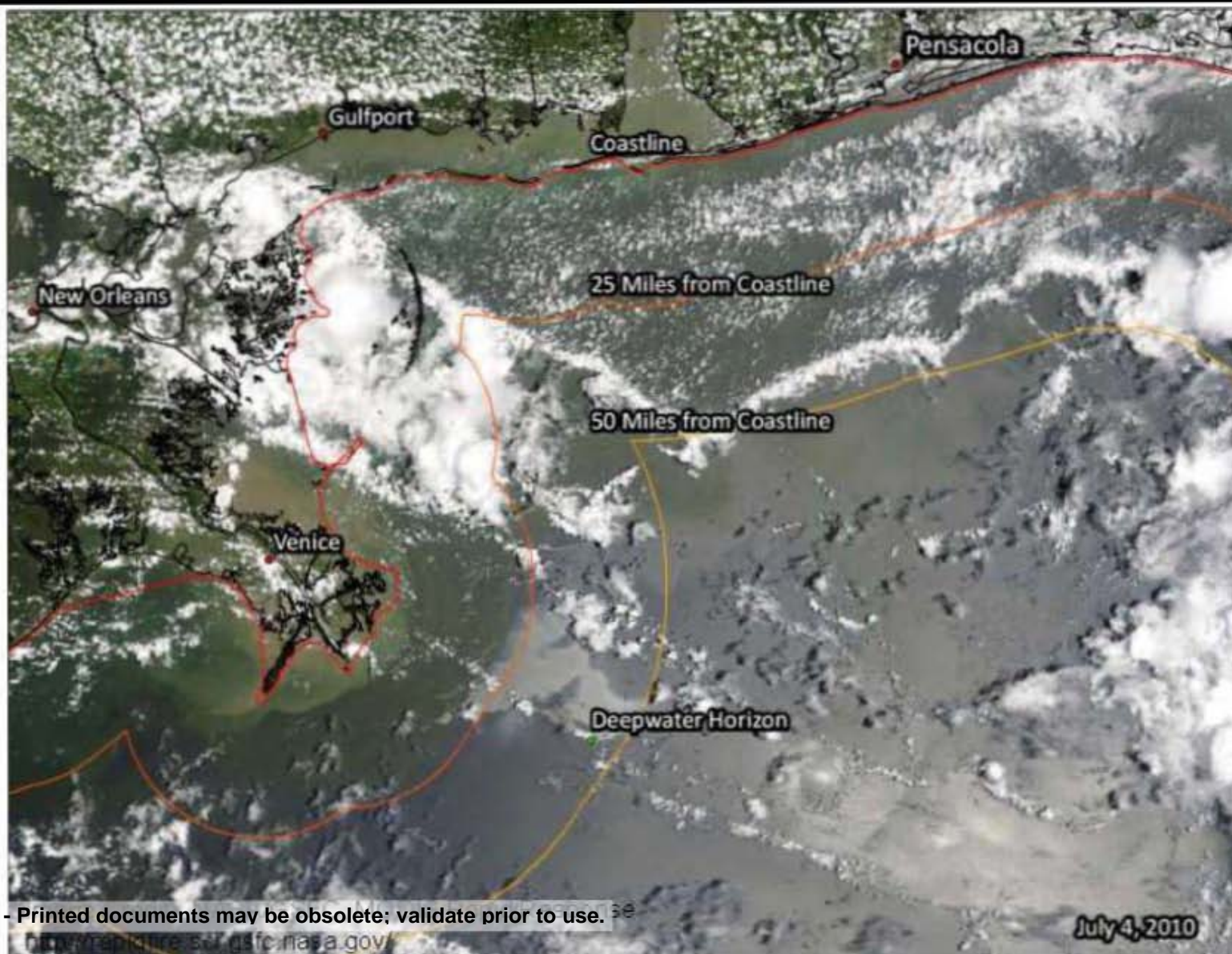
MODIS – June 26, 2010



RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov>

MODIS – July 4, 2010

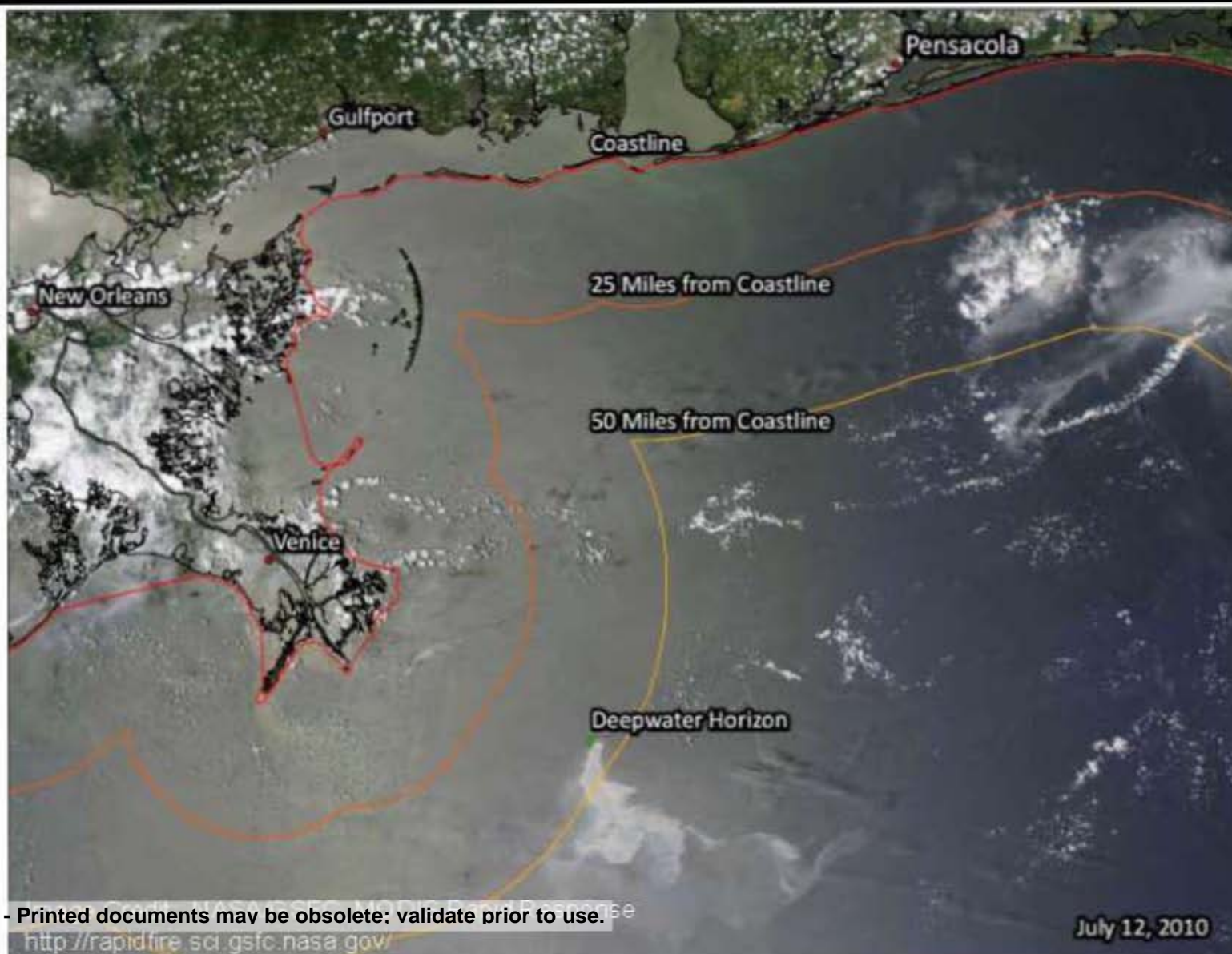


RELEASED - Printed documents may be obsolete; validate prior to use. 38

<http://rapidresponse.gsfc.nasa.gov/>

July 4, 2010

MODIS – July 12, 2010

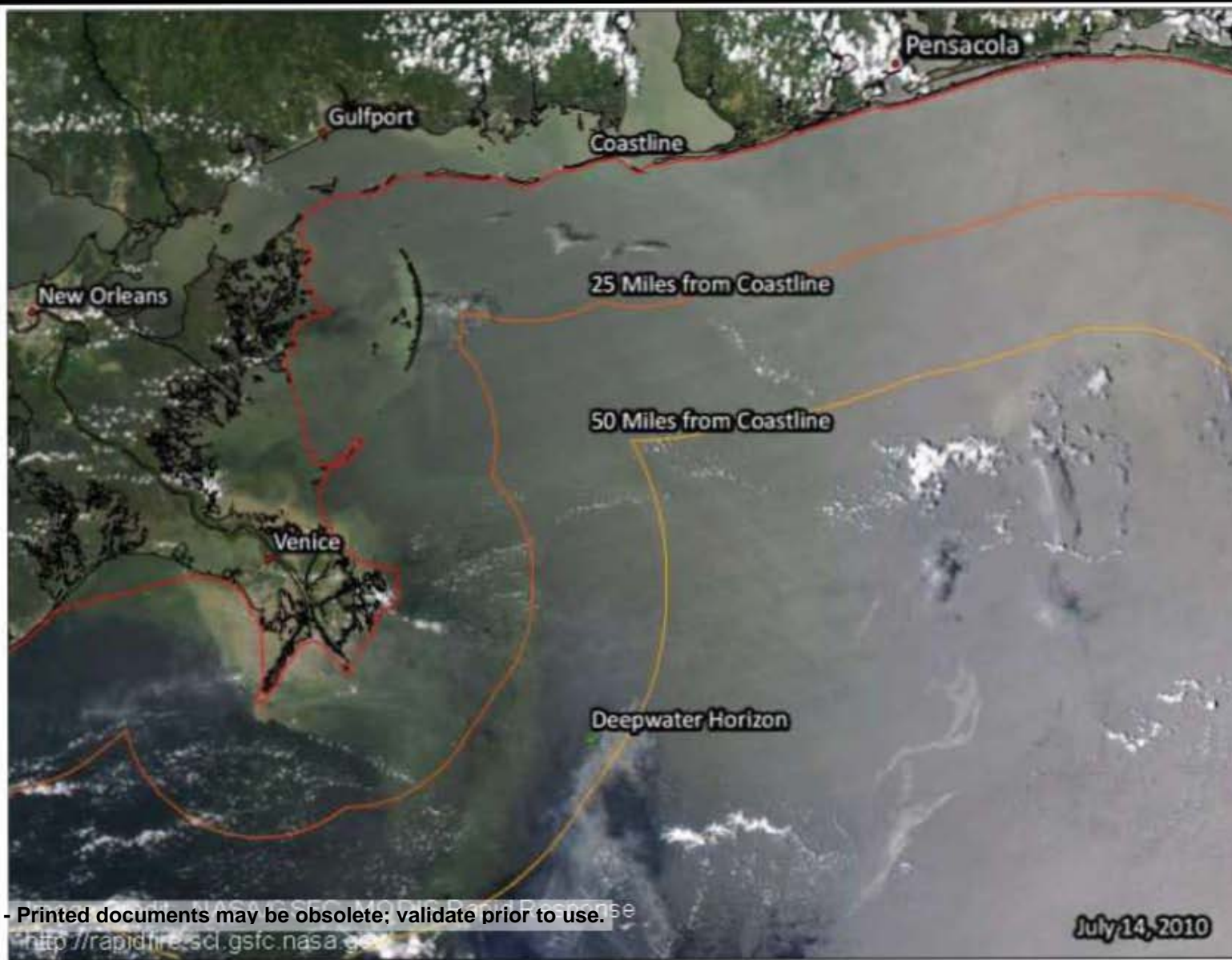


RELEASED - Printed documents may be obsolete; validate prior to use.

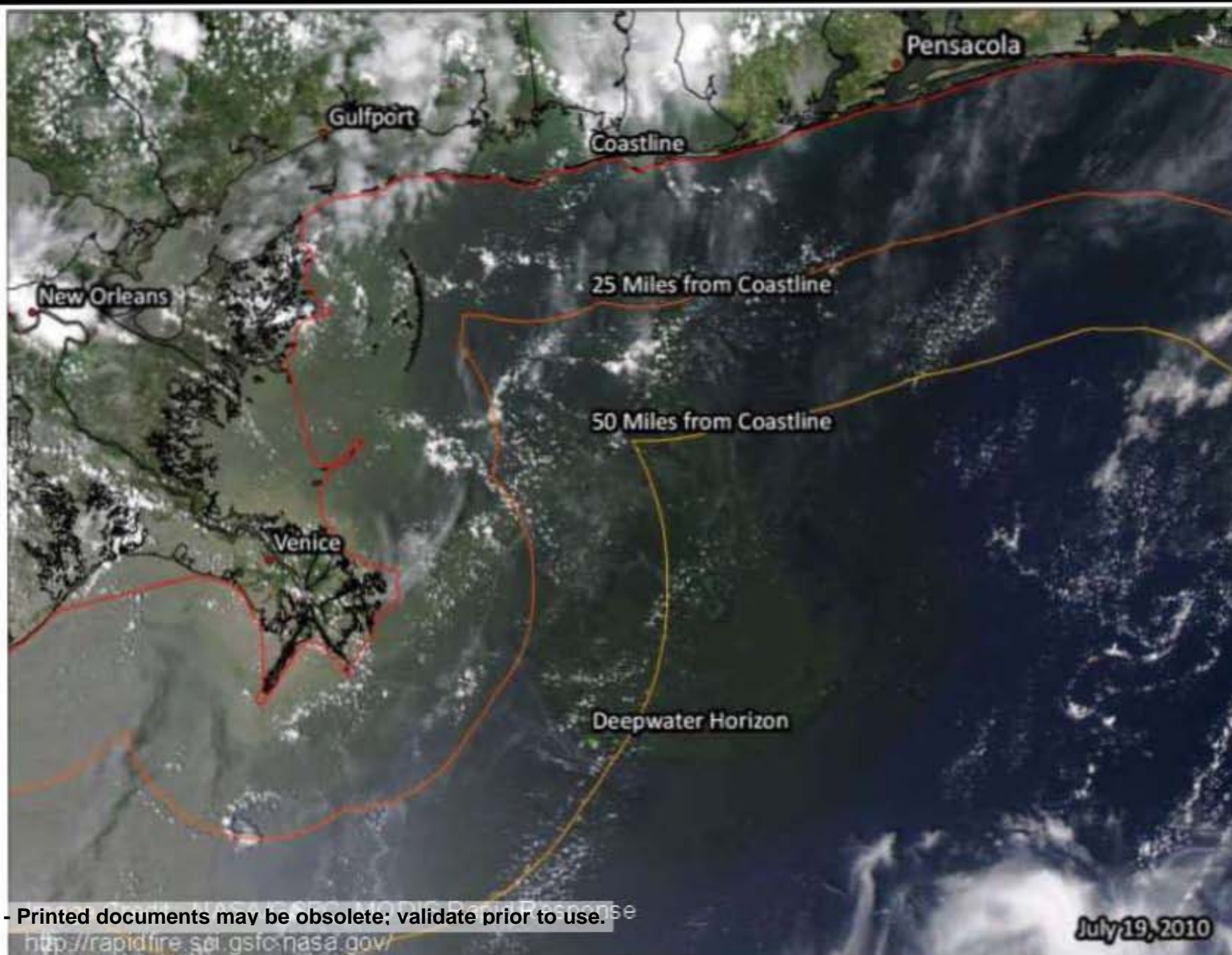
<http://rapidfire.sci.gsfc.nasa.gov/>

July 12, 2010

MODIS – July 14, 2010



MODIS – July 19, 2010

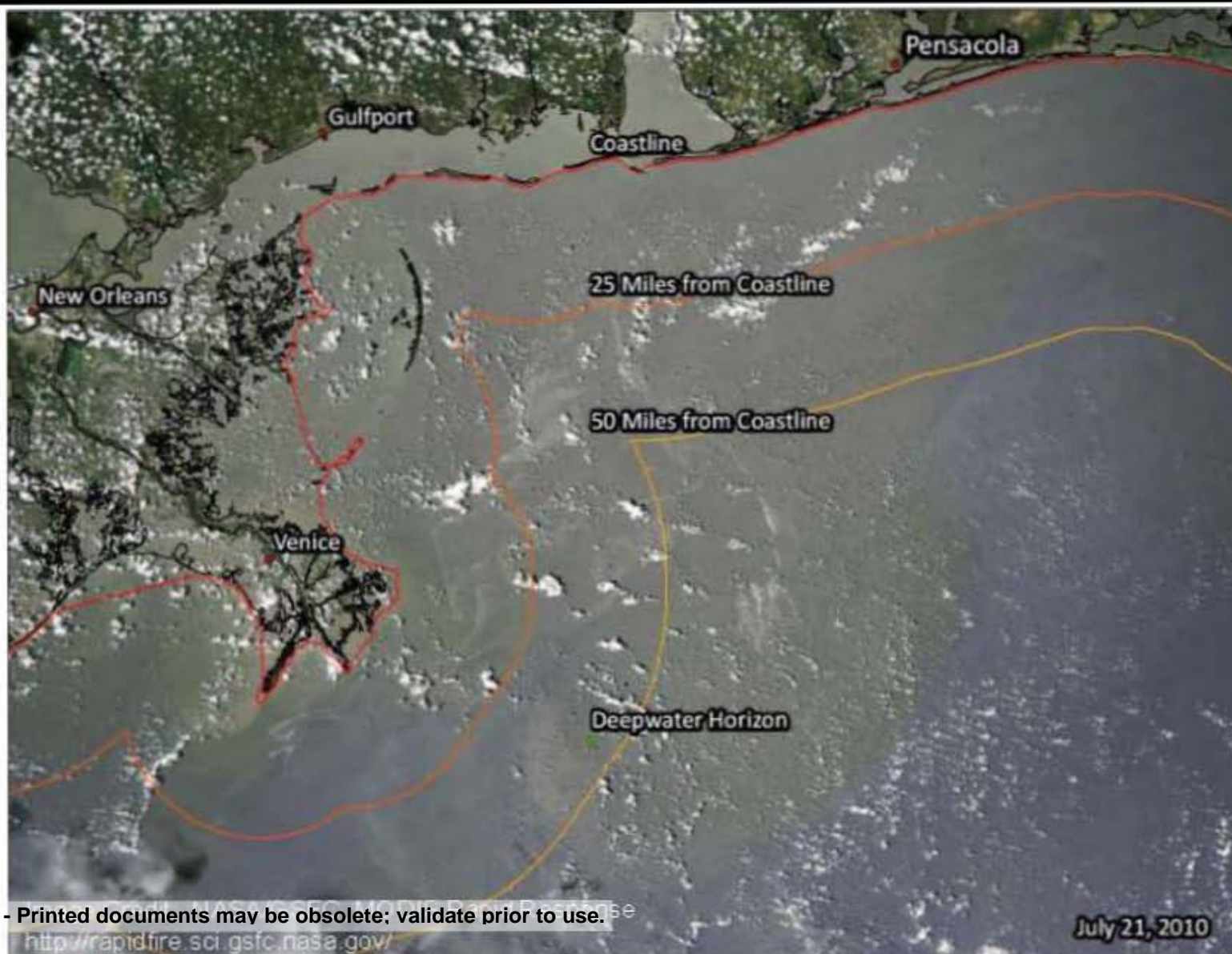


RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov/>

July 19, 2010

MODIS – July 21, 2010

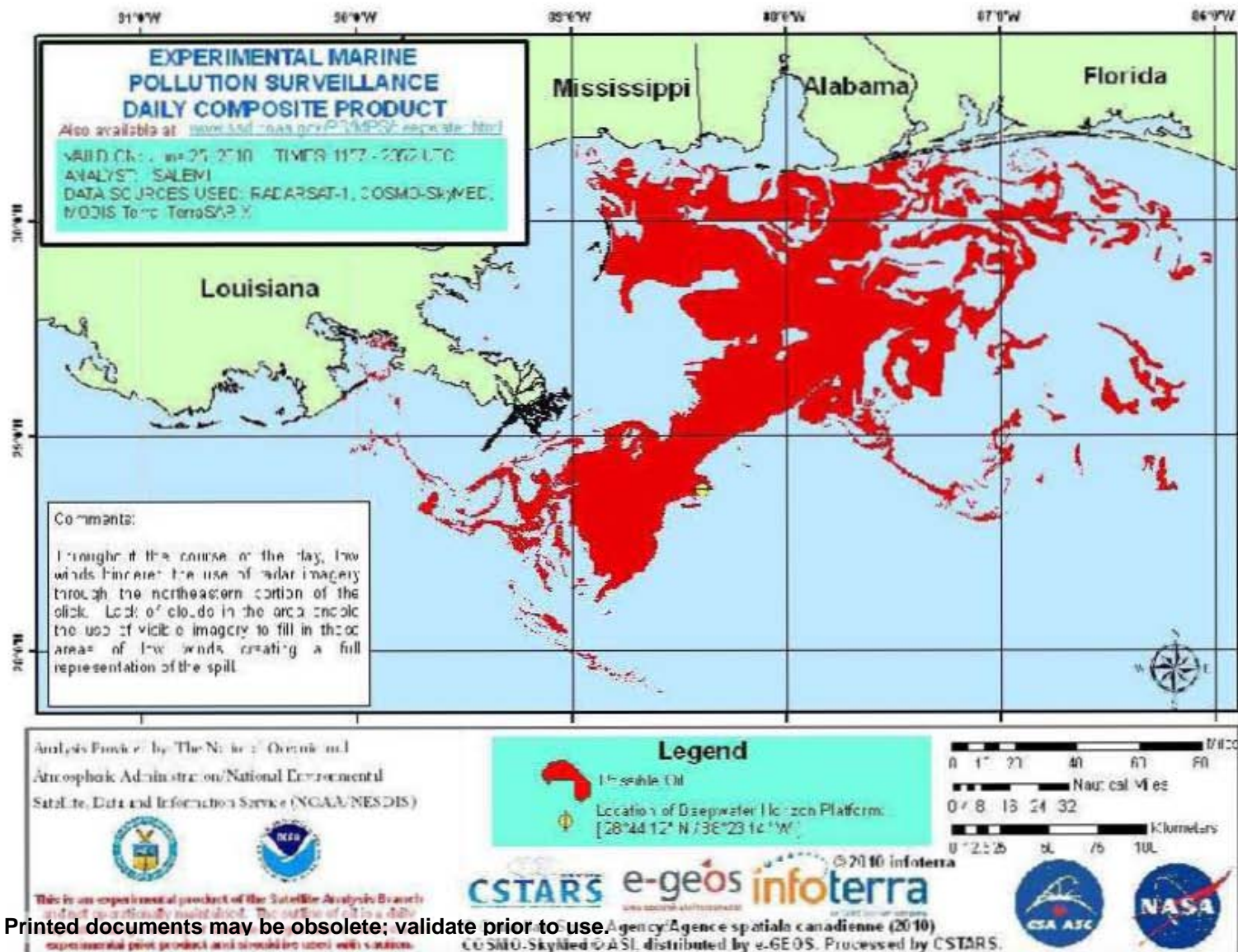


RELEASED - Printed documents may be obsolete; validate prior to use.

<http://rapidfire.sci.gsfc.nasa.gov/>

July 21, 2010

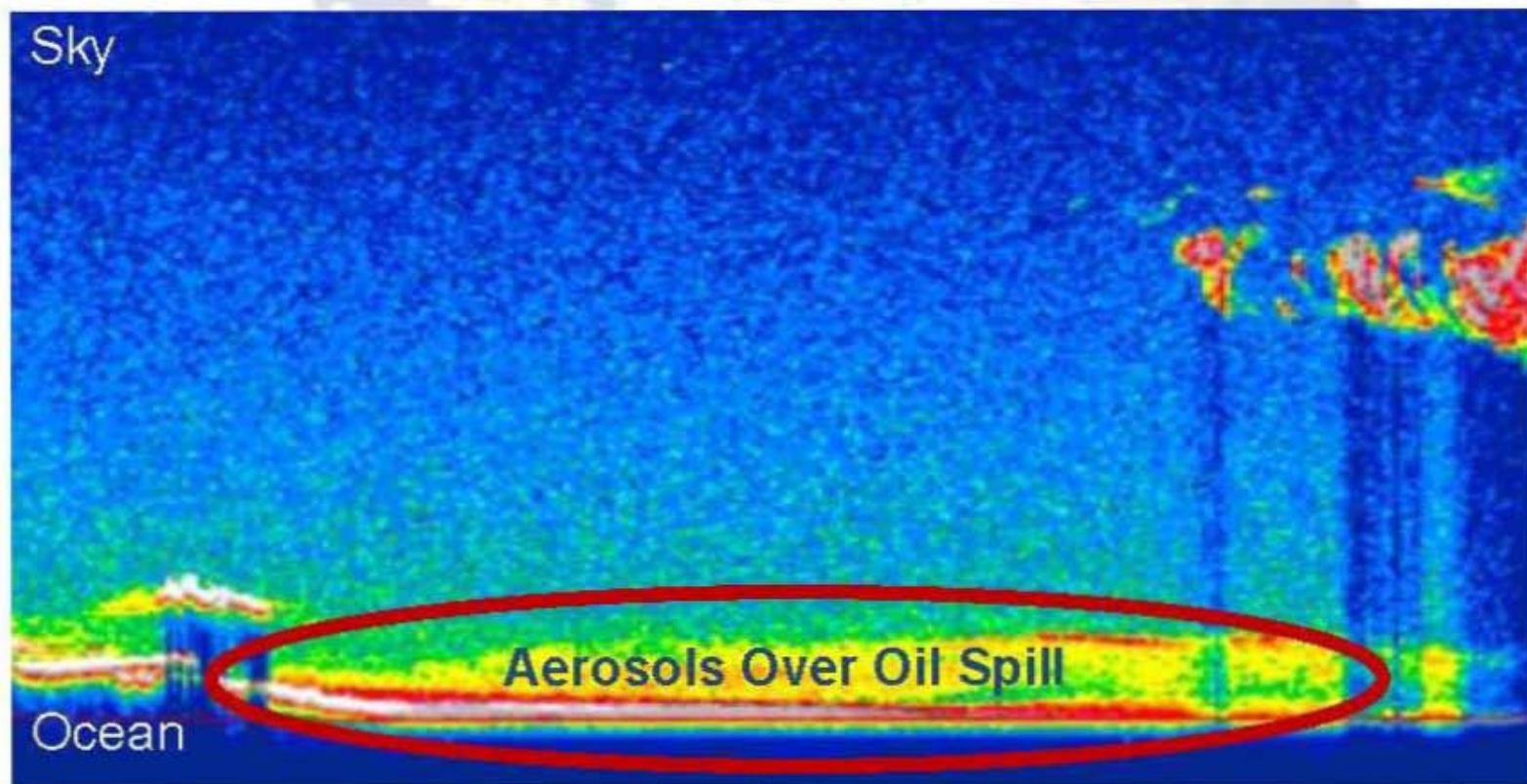
Example of a MODIS-derived Product



CALIOP



- Cloud-Aerosol LiDAR with Orthogonal Polarization
- Onboard the *CALIPSO* satellite
- NASA / CNES (French) joint sensor mission



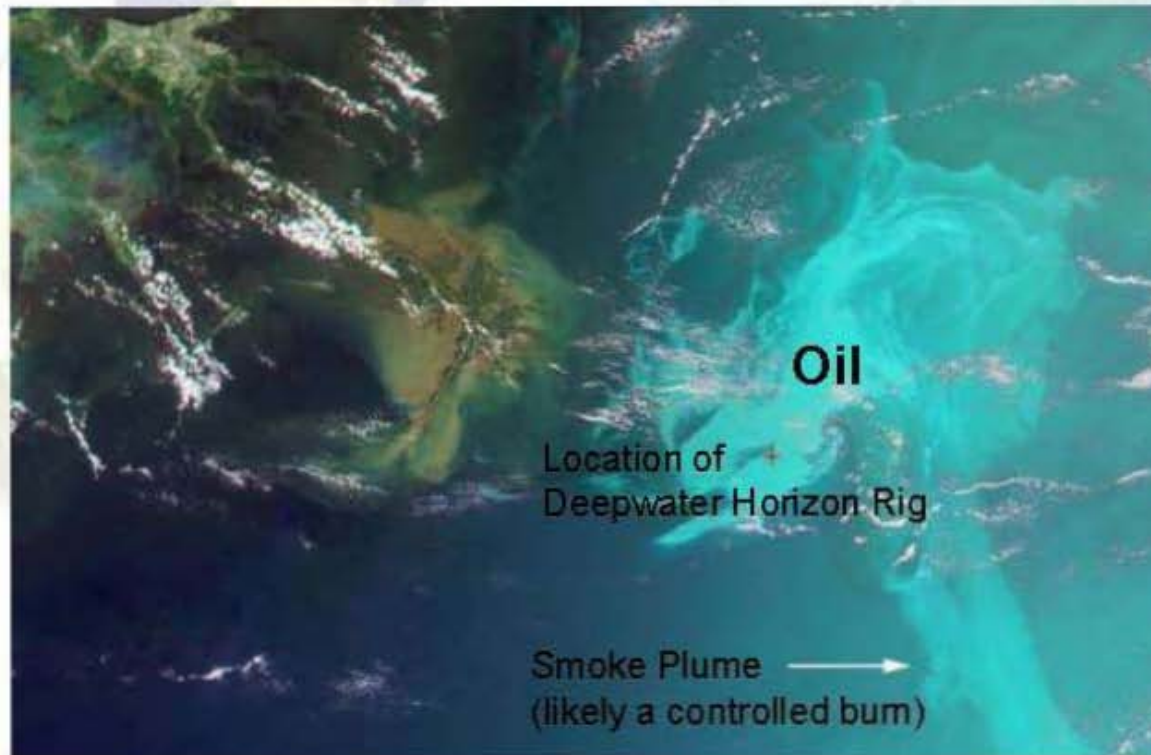
RELEASED - Printed documents may be obsolete; validate prior to use.

Cross-Section View of CALIOP Data – May 2, 2010. Image Credit: NASA

MISR



- Multi-angle Imaging SpectroRadiometer
- Nine cameras with different view angles
- Experimental use for surface oil detection



MISR Image. May 17, 2010. Image Credit: NASA

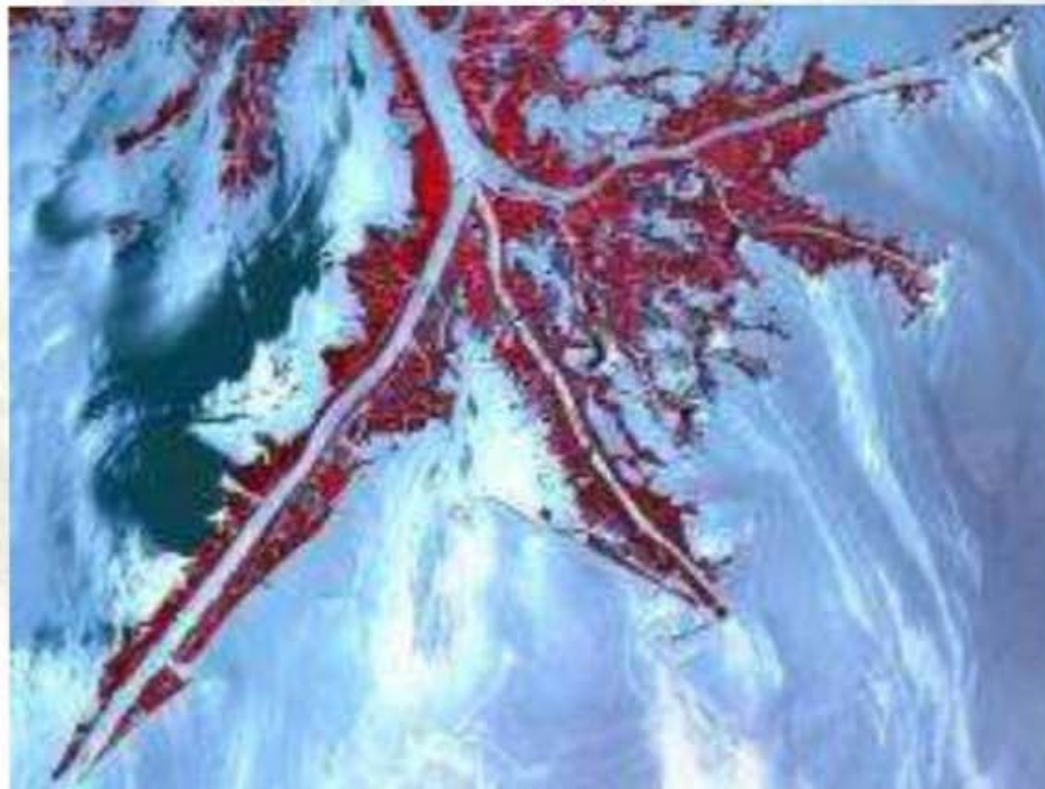
RELEASED - Printed documents may be obsolete; validate prior to use.

Red Band (26° Forward-viewing) + Blue and Green Bands (Nadir)

ASTER



- Advanced Spaceborne Thermal Emission and Reflection Radiometer onboard *Terra*
- NASA / METI (Japanese) joint sensor mission



ASTER Image of Mississippi River Delta. May 24, 2010.

RELEASED - Printed documents may be obsolete; validate prior to use.

Image Credit: NASA

TM, ETM+, and ALI



- Thematic Mapper onboard *Landsat 5* (USGS / NASA)
- Enhanced TM+ onboard *Landsat 7* (USGS / NASA)
- Advanced Land Imager onboard *EO-1*



Landsat 5 TM Image of MS River Delta. May 5, 2009

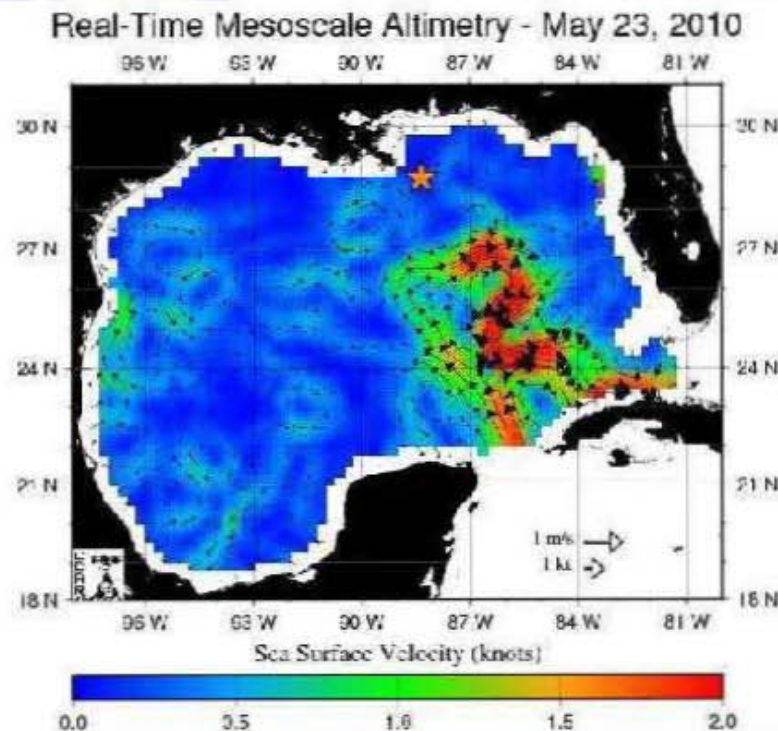
RELEASED - Printed documents may be obsolete; validate prior to use.

Image Credit: USGS / NASA

Jason-1 and OSTM / Jason-2



- Jason-1 and Ocean Surface Topography Mission
- NASA / CNES (French) joint missions
- Radar altimeters – ocean surface heights



Gulf of Mexico Currents Derived from Radar Altimetry. May 23, 2010.

RELEASED - Printed documents may be obsolete; validate prior to use.

Image Credit: NASA/JPL/ University of Colorado

International Space Station Photography



- Astronaut photographs
- Oblique angles



Astronaut Photograph of Deepwater Horizon Oil Spill. May 4, 2010.

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Image Credit: NASA

NASA Sensor Coastal Application Summary

NASA Airborne Sensors:

Sensor	Applications
HSRL	air quality, sub-surface oil (experimental), phytoplankton (experimental)
AVIRIS	surface oil thickness, wetlands health
UAVSAR	marsh oiling (experimental)
Sensor	Applications

NASA Spaceborne Sensors:

Sensor	Applications
HSRL	air quality, sub-surface oil (experimental), phytoplankton (experimental)
AVIRIS	surface oil thickness, wetlands health
UAVSAR	marsh oiling (experimental)
Sensor	Applications
MODIS	surface oil tracking, wetlands health, HABs, turbidity, etc.
CALIOP	air quality, surface oil detection (experimental)
MISR	surface oil delineation (experimental)
ASTER	wetlands health, surface oil tracking
TM / ETM+	wetlands health, surface oil tracking
ALL	wetlands health, surface oil tracking
Jason-1	sea surface height, ocean currents

Sensor Websites



<http://science.larc.nasa.gov/hsrl/index.html> - HSRL

<http://aviris.jpl.nasa.gov/> - AVIRIS

<http://uavsar.jpl.nasa.gov/> - UAVSAR

<http://modis.gsfc.nasa.gov/> - MODIS

<http://www-calipso.larc.nasa.gov/> - CALIPSO (carries the CALIOP sensor)

<http://www-misr.jpl.nasa.gov/> - MISR

<http://asterweb.jpl.nasa.gov/> - ASTER

<http://landsat.gsfc.nasa.gov/> or <http://landsat.usgs.gov/> - Landsat TM and ETM+

<http://eo1.gsfc.nasa.gov/Technology/ALIhome1.htm> - ALI

<http://topex-www.jpl.nasa.gov/mission/jason-1.html> - Jason-1

<http://topex-www.jpl.nasa.gov/mission/ostm.html> - OSTM/Jason-2

<http://eol.jsc.nasa.gov/> or <http://spaceflight1.nasa.gov/gallery/> - ISS and Astronaut Photography

A large, semi-transparent satellite image of Earth serves as the background for the title. It shows the Gulf of Mexico, Central America, and parts of North and South America. The image is centered on the Gulf of Mexico, with the title text overlaid in the middle.

NASA's Gulf of Mexico Initiative

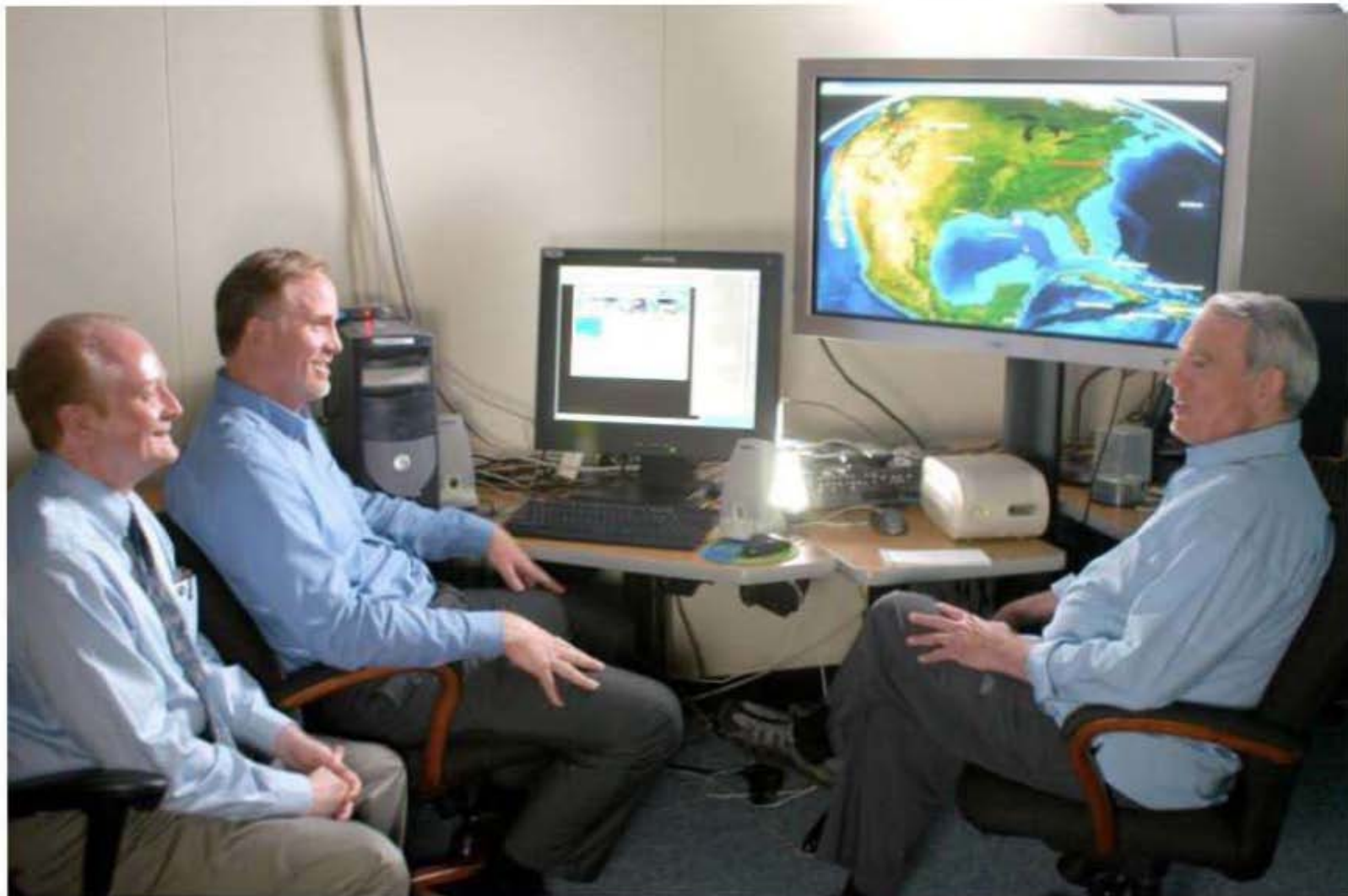
NASA's Gulf of Mexico Initiative (GOMI)



- GOMI is managed by the Applied Science and Technology Project Office at Stennis.
- NASA has awarded over \$18 million for Gulf of Mexico research since 2008.
- Before the spill, GOMI was conducting 35 projects in all 5 Gulf Coast states.

<http://www.coastal.ssc.nasa.gov/>

Dan Rather's Visit to Stennis



Duane Armstrong (ASTPO) and Richard Brown (CSC) Meet with Dan Rather.

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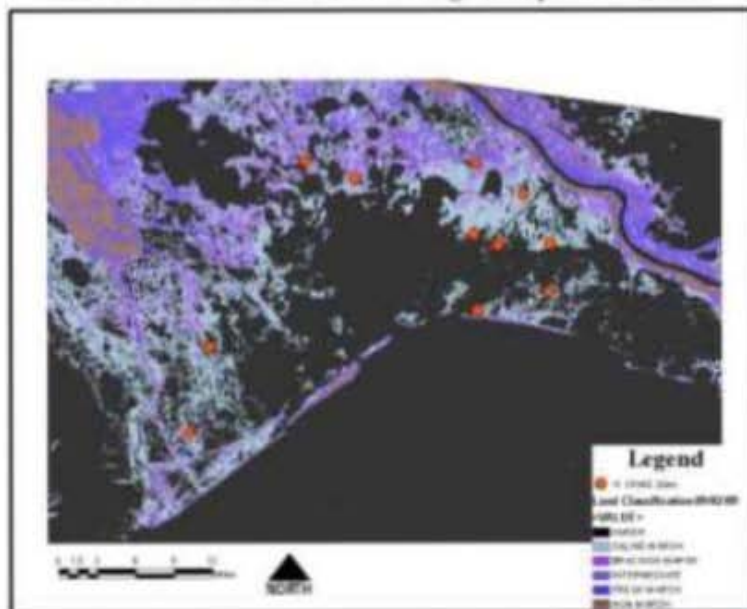
Image Credit: Richard Brown

Student Research at Stennis

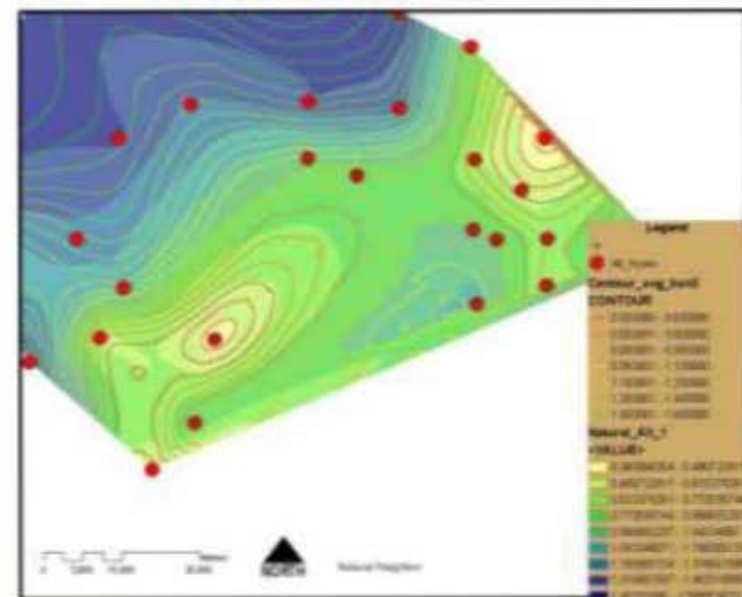


- NASA DEVELOP Program
- NASA INSPIRE Program
- NASA ACCESS Program
- NASA USRP Program

Land Classification of Landsat 5 Image on September 2, 2009



August 16, 2009 20:00:08 Low Tide



A large, faded image of the Earth from space serves as the background for the central text. It shows the Western Hemisphere, including North and South America, the Atlantic Ocean, and parts of Europe and Africa. The colors are muted, with blues for the oceans and greens/browns for the landmasses.

Sources for More Information Regarding the Deepwater Horizon Oil Spill

Some Useful Websites



<http://www.restorethegulf.gov>

Official Federal Portal for Oil Spill Response/Recovery

<http://www.geoplatform.gov/gulfresponse/>

Online Oil Spill Mapping Tool

www.nasa.gov/topics/earth/features/oilspill/index.html

NASA Oil Spill Imagery and Articles

Sources for Geospatial Imagery



<http://hdds.usgs.gov/hdds/>

USGS Repository of Imagery and Data

ALI

ASTER

AVIRIS

Hyperion

Landsat

MODIS

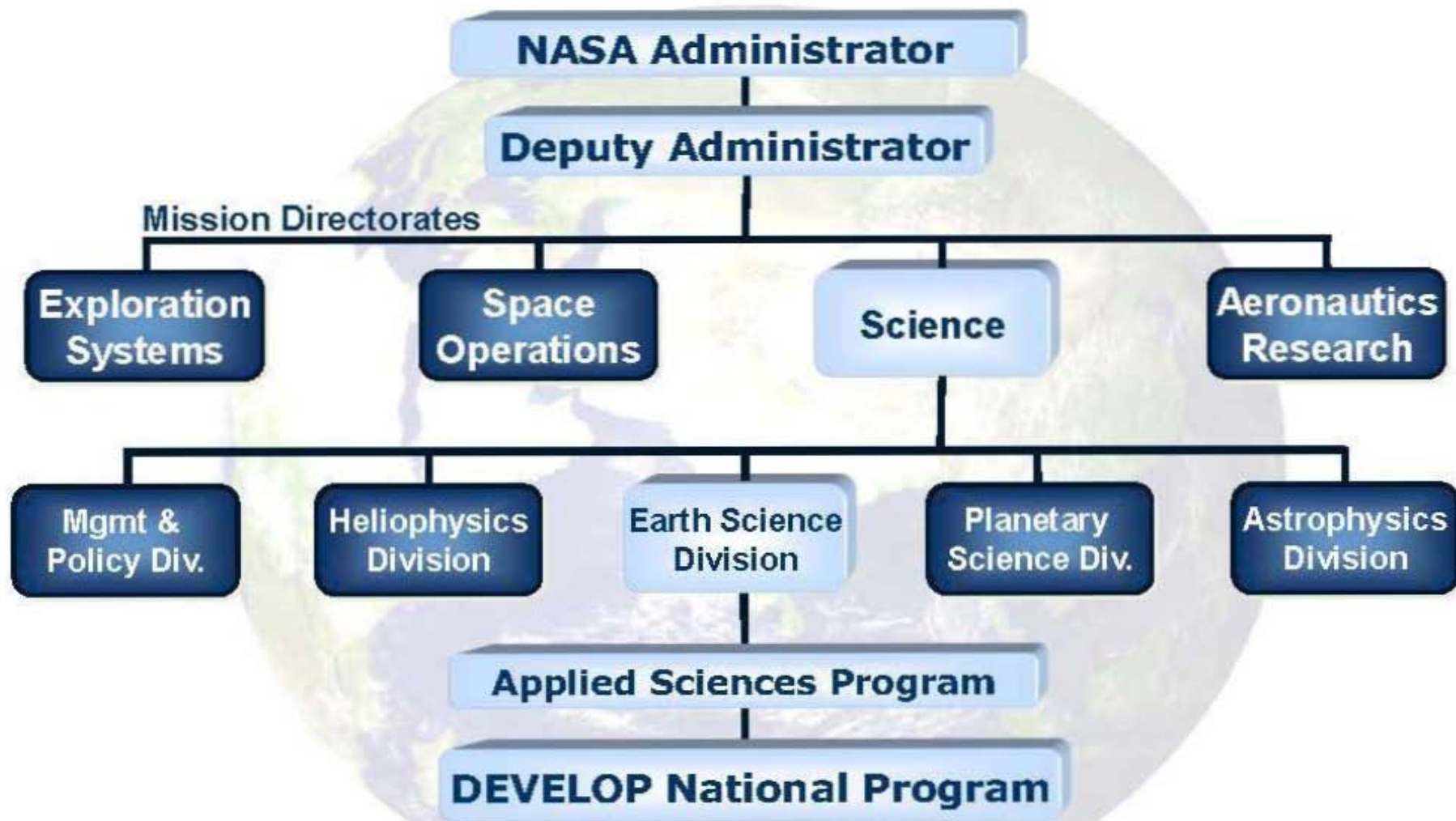
UAVSAR

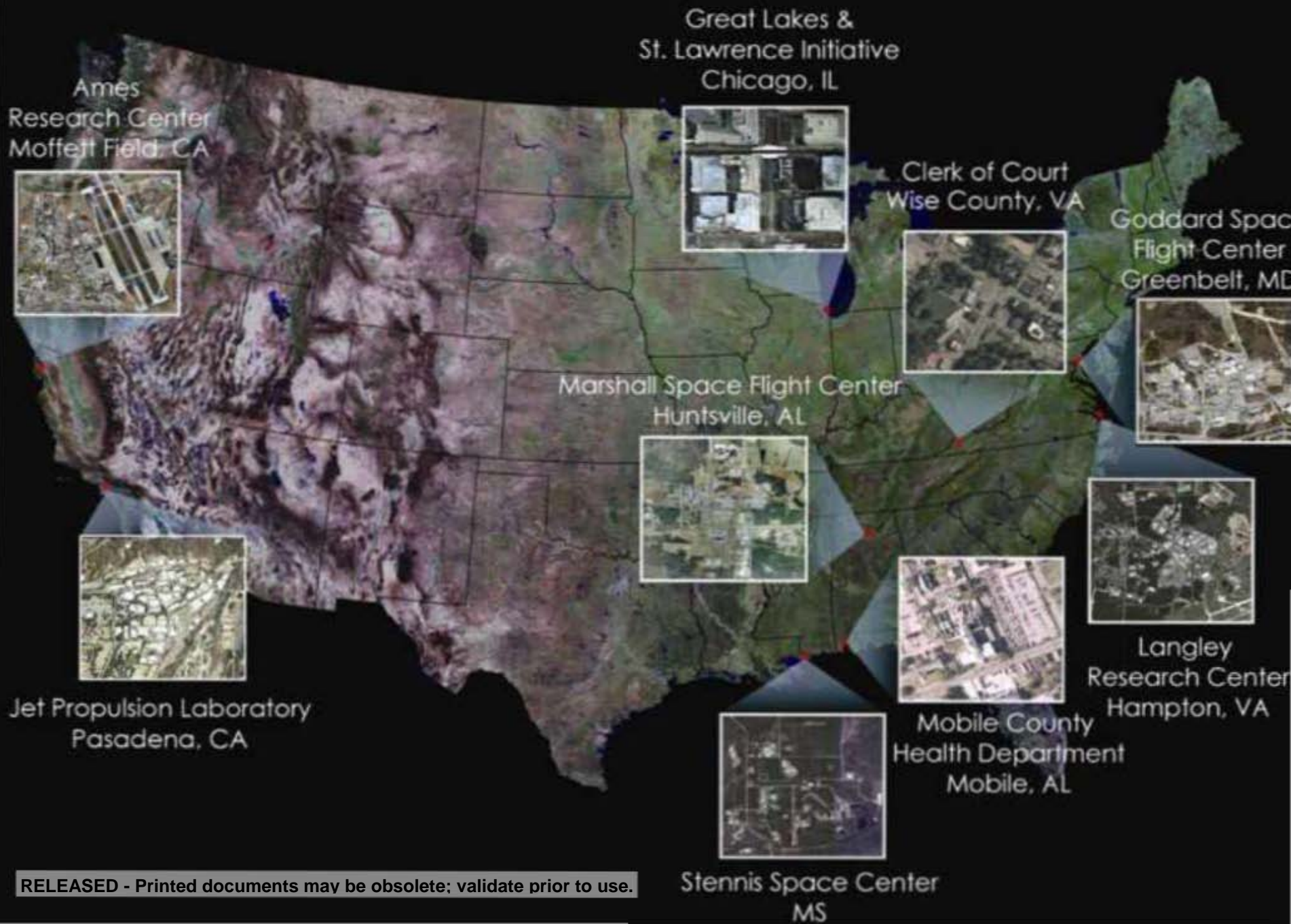
Others

A large, semi-transparent image of the Earth from space, showing the continents of North and South America, is centered in the background of the slide.

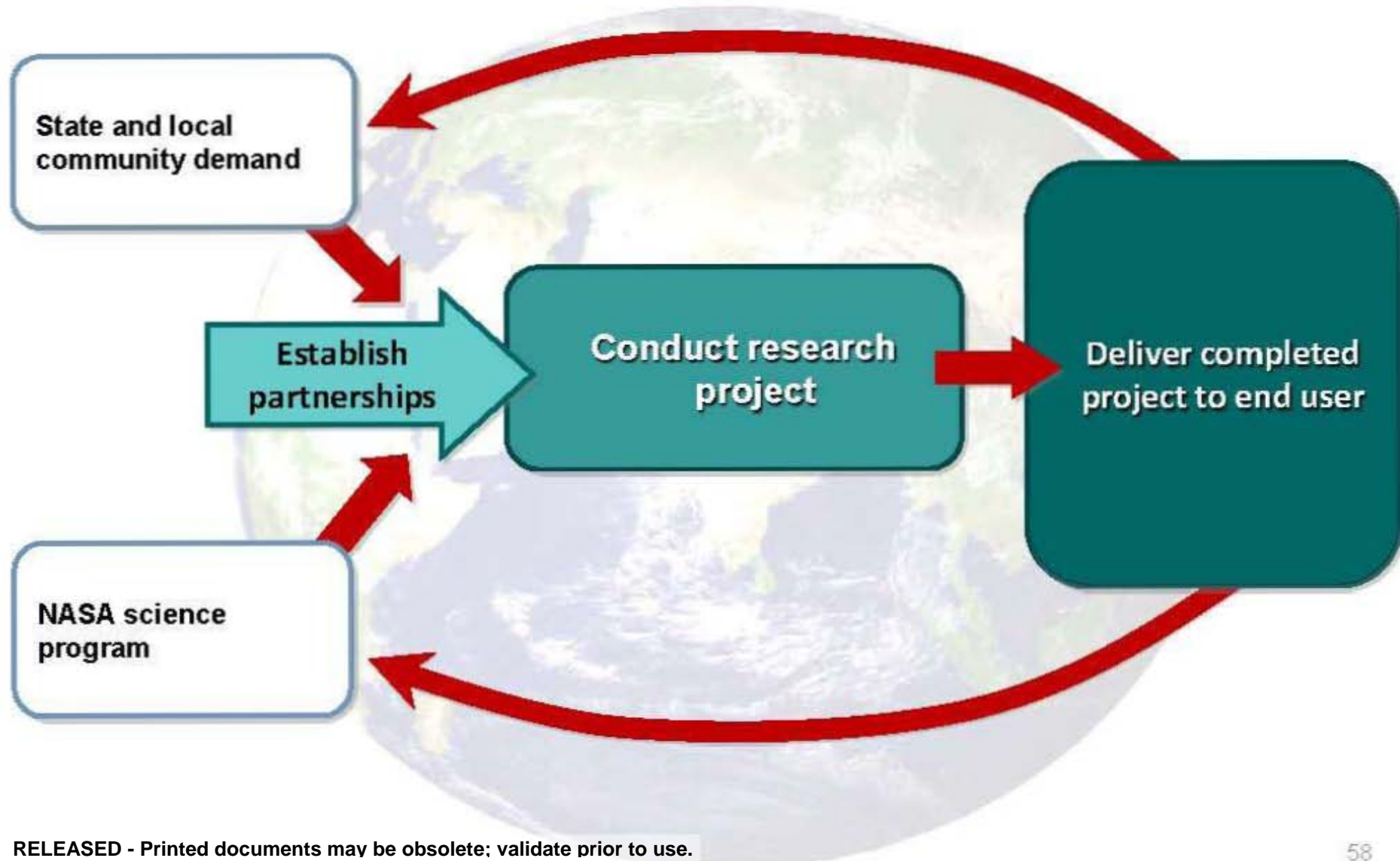
DEVELOP Program Overview and Internship Opportunities

NASA Earth Science





DEVELOP Project Lifecycle



DEVELOP Oil Spill Air Quality Project (Fall 2010)



- Stennis/Mobile/Langley DEVELOP collaboration
- Analyzing potential public health risks from oil fumes
- CALIOP, MODIS, & Ozone Monitoring Instrument
- Correlations with public health data



Example of EPA
Air Now Data for PM 2.5 (left)
Showing Moderate Levels
of PM 2.5 along the Gulf Coast
on May 29, 2010

Image Credit: EPA

Joining DEVELOP



- Spring Term: January 24 – April 1
- Application Deadline: November 15
- Summer Term: June 6 – August 12, 2011
- Application Deadline: February 28, 2011
- Paid internship
- Must have at least a 3.0 GPA on a 4 point scale
- Must be a U.S. citizen to work at a NASA center
- Citizenship not required at extension offices

<http://develop.larc.nasa.gov>

Questions / Comments



Questions?

Comments?

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dstodghill@msn.com

251-544-2123

<http://develop.larc.nasa.gov>

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
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				5f. WORK UNIT NUMBER	
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				11. SPONSORING/MONITORING REPORT NUMBER	
12. DISTRIBUTION/AVAILABILITY STATEMENT Unclassified - Unlimited Subject Category 43 Availability: NASA CASI (301) 621-0390					
13. SUPPLEMENTARY NOTES presentation for website					
14. ABSTRACT The Power Point presentation gives an overview of both the airborne and spaceborn remote sensing missions that NASA used to collect imagery and data over the Deepwater Horizon Oil Spill. It also provides basic information about some of the ongoing NASA and university research projects that are utilizing the aforementioned data. The presentation also discusses the importance of NASA's Gulf of Mexico Initiative to research in the Gulf of Mexico. The presentation concludes with information about how students can get involved with NASA-sponsored applied science projects by interning with the NASA DEVELOP student program.					
15. SUBJECT TERMS Geographic Information Systems (GIS), Terra, Nonpoint Source pollution, watersheds, Remote Sensing, Deepwater Horizon Oil Spill, coastal, earth science, airborne, spaceborne, North Alabama University, DEVELOP					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19b. NAME OF RESPONSIBLE PERSON
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